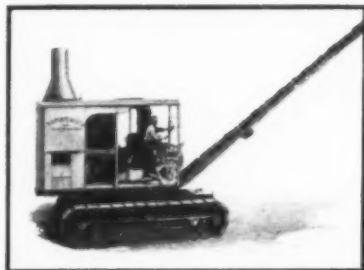
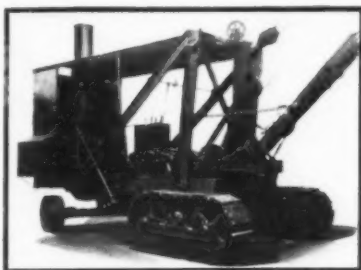


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Camden Iron Works, Camden, N. J.  
Canton Fdry. & Mach. Co., Canton, Ohio.  
Clark Co., H. W., Mattoon, Ill.  
Flower Valve Mfg. Co., Detroit, Mich.  
Glamorgan Pipe & Foundry Co., Lynchburg, Va.  
Gray Iron Fdry. Co., Reading, Pa.  
Jeffrey Mfg. Co., Columbus, O.  
Link-Belt Co., Chicago, Ill.  
Marion Malleable Iron Works, Marion, Ind.  
Pechstein Iron Works, Keokuk, Iowa.  
Sessions Fdry. Co., Bristol, Conn.  
Spedel, J. G., Reading, Pa.  
Warren Fdry. & Mach. Co., N. Y. C.

#### CASTINGS, STREET AND SEWER

\*Central Fdry. Co., N. Y. C.  
\*Lynchburg Fdry. Co., Lynchburg, Va.  
\*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.  
Casey-Hedges Co., Chattanooga, Tenn.  
Clow & Sons, J. B., Chicago, Ill.  
Dee Co., W. E., Chicago, Ill.  
Pechstein Iron Works, Keokuk, Ia.

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\*Clark Co., H. W., Mattoon, Ill.  
\*U. S. Cast Iron Pipe & Fdry. Co., Burlington, N. J.  
Canton Fdry. & Mach. Co., Canton, Ohio.  
Casey-Hedges Co., Chattanooga, Tenn.  
Clow & Sons, J. B., Chicago, Ill.  
Dee Co., W. E., Chicago, Ill.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Foundry Mfg. Co., St. Albans, Vt.  
Madison Fdry. Co., Cleveland, O.  
Pechstein Iron Works, Keokuk, Iowa.  
Sessions Fdry. Co., Bristol, Conn.

#### CATCH BASIN CLEANING APPARATUS

\*Elgin Sales Corp., New York.  
International Motor Co., New York.

#### CAULKING MACHINERY

\*Smith Mfg. Co., A. F., East Orange, N. J.  
Helwig Mfg. Co., St. Paul, Minn.  
Ingersoll-Rand Co., N. Y. C.

#### CAULKING MATERIALS

\*United Lead Company, New York.  
Leadite Co., Philadelphia, Pa.  
Mueller Mfg. Co., H., Decatur, Ill.

#### CEMENT

\*Pennsylvania Cement Co., New York.  
Etna Portland Cement Co., Detroit, Mich.  
Allentown Portland Cement Co., Allentown, Pa.  
Alpha Portland Cement Co., Easton, Pa.  
Ash Grove Lime and Portland Cement Co., Kansas City, Mo.  
Atlas Portland Cement Co., New York.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.



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If you need a good engine with a lot of power in its system and a willingness to use it liberally on any sort of a job, take a look at the

# CLIMAX T. U.

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800 R. P. M.

5½ Bore  
7" Stroke

It's a real power giant, capable of tackling the toughest job and finishing it up in a hurry.

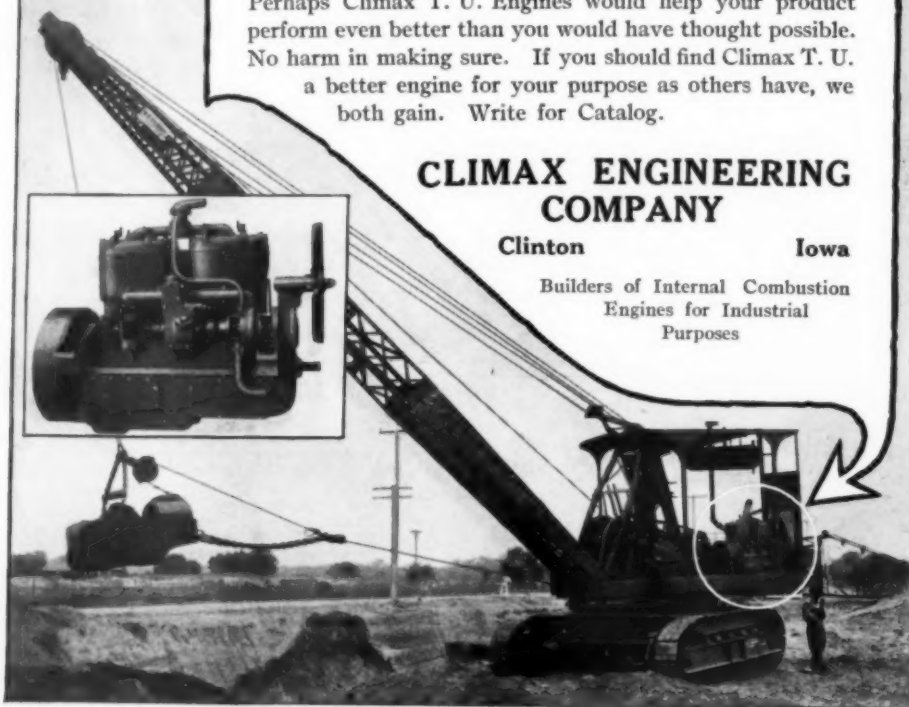
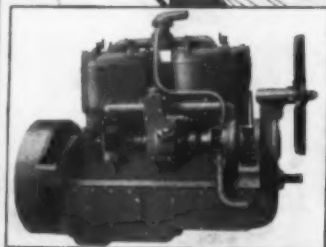
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 Bonner Portland Cement Co., Kansas City, Mo.  
 Canada Cement Co., Ltd., Montreal, Canada.  
 Cape Girardeau Portland Cement Co., Cape Girardeau, Mo.  
 Castalia Portland Cement Co., Pittsburgh, Pa.  
 Clinchfield Portland Cement Corp., Kingsport, Tenn.  
 Colorado Portland Cement Co., Denver, Colo.  
 Continental Portland Cement Co., St. Louis, Mo.  
 Coplay Cement Manufacturing Co., Coplay, Pa.  
 Cowell Portland Cement Co., San Francisco, Cal.  
 Crescent Portland Cement Co., Wampum, Pa.  
 Dewey Portland Cement Co., Kansas City, Mo.  
 Dexter Portland Cement Co., Nazareth, Pa.  
 Diamond Portland Cement Co., Cleveland, Ohio.  
 Dixie Portland Cement Co., Chattanooga, Tenn.  
 Edison Portland Cement Co., New York.  
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 Giant Portland Cement Co., Philadelphia, Pa.  
 Gilmore Portland Cement Corp., Gilmore City, Iowa.  
 Glens Falls Portland Cement Co., Glens Falls, N. Y.  
 Golden State Portland Cement Co., Los Angeles, Cal.  
 Gulf States Portland Cement Co., Demopolis, Ala.  
 Hawkeye Portland Cement Co., Des Moines, Ia.  
 Helderberg Cement Co., Albany, N. Y.  
 Hercules Cement Corp., Philadelphia, Pa.  
 Indiana Portland Cement Co., Indianapolis, Ind.  
 International Portland Cement Co., Ltd., Spokane, Wash.  
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 Kosmos Portland Cement Co., Louisville, Ky.  
 Lawrence Portland Cement Co., Northampton, Pa.  
 Lehigh Portland Cement Co., Allentown, Pa.  
 Louisville Cement Co., Louisville, Ky.  
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 Missouri Portland Cement Co., St. Louis, Mo.  
 Monarch Cement Co., Humboldt, Kans.  
 Nazareth Cement Co., Nazareth, Pa.  
 Newaygo Portland Cement Co., Newaygo, Mich.  
 Nebraska Cement Co., Denver, Colo.  
 New Egyptian Portland Cement Co., Fenton, New York & New England Cement & Lime Co., New York.  
 Northwestern States Portland Cement Co., Mason City, Ia.  
 Ogden Portland Cement Co., Ogden, Utah.  
 Oklahoma Portland Cement Co., Denver, Colo.  
 Old Mission Portland Cement Co., San Francisco, Cal.  
 Olympic Portland Cement Co., Ltd., Seattle, Wash.  
 Oregon Portland Cement Co., Portland, Ore.  
 Pacific Portland Cement Co., San Francisco, Cal.  
 Peerless Portland Cement Co., Union City, Mich.  
 Peninsular Portland Cement Co., Cement City, Mich.  
 Penn-Allen Cement Co., Allentown, Pa.  
 Petoskey Portland Cement Co., Petoskey, Mich.  
 Phoenix Portland Cement Co., Nazareth, Pa.  
 Portland Cement Co. of Utah, Salt Lake City, Utah.  
 Pyramid Portland Cement Co., Des Moines, Ia.  
 Riverside Portland Cement Co., Los Angeles, Cal.  
 San Antonio Portland Cement Co., San Antonio, Tex.  
 Sandusky Cement Co., Cleveland, Ohio.  
 Santa Cruz Portland Cement Co., San Francisco, Cal.  
 Security Cement and Lime Co., Hagerstown, Md.  
 Signal Mountain Portland Cement Co., Chattanooga, Tenn.  
 Southern States Portland Cement Co., Rockport, Ga.  
 Southwest Portland Cement Co., El Paso, Tex.  
 Standard Portland Cement Corp., San Francisco, Calif.  
 Superior Portland Cement Co., Seattle, Wash.  
 Texas Portland Cement Co., Dallas, Tex.  
 Three Forks Portland Cement Co., Denver, Colo.  
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 Trinity Portland Cement Co., Dallas, Tex.  
 Union Portland Cement Co., Ogden, Utah.  
 United States Potash Co., Los Angeles, Cal.  
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Universal Portland Cement Co., Chicago, Ill.  
 Vulcanite Portland Cement Co., Philadelphia, Pa.  
 Wabash Portland Cement Co., Detroit, Mich.  
 Wellston Iron Furnace Co., Jackson, Ohio.  
 Western States Portland Cement Co., Independence, Kans.  
 Whitehall Cement Mfg. Co., Philadelphia, Pa.  
 Wolverine Portland Cement Co., Coldwater, Mich.  
 Wyandotte Portland Cement Co., Detroit, Mich.

### CEMENT INSPECTION (See Inspecting Laboratories)

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 American Chain Co., Inc., Bridgeport, Conn.  
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 Link-Belt Co., Chicago, Ill.  
 Niagara Metal Stamp Corp., Niagara Falls, N. Y.  
 U. S. Chain & Forge Co., Pittsburgh, Pa.  
 Webster Mfg. Co., Chicago, Ill.

#### CHECK VALVES

Columbian Iron Works, Chattanooga, Tenn.  
 Ludlow Valve Mfg. Co., Troy, N. Y.  
 Lunkenheimer Co., Cincinnati, O.  
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#### CHEMICALS FOR WATER PURIFICATION

Du Pont de Nemours & Co., E. I., Wilmington, Del.  
 Electro Bleaching Gas Co., New York.  
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 Mathieson Alkali Works, Inc., N. Y. C.  
 Penna. Salt Mfg. Co., Philadelphia, Pa.

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 Weber Chimney Co., Chicago, Ill.

#### CHIMNEYS, RADIAL BRICK

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 Custodia Chimney Const. Co., Alphons, New York.  
 Kellogg & Co., M. W., New York.  
 Rust Engineering Co., Pittsburgh, Pa.

#### CHIMNEYS, STEEL (See Stacks, Steel)

#### CHLORINATORS

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#### CHLORINE, LIQUID (See Liquid Chlorine)

#### CHUTES, CONCRETE

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 Lakewood Engineering Co., Cleveland, O.  
 Ransome Concrete Machy. Co., Dunellen, N. J.

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American Hoist & Derrick Co., St. Paul, Minn.  
 American Steel & Wire Co., Chicago, Ill.  
 Broderick & Bascom Rope Co., St. Louis, Mo.  
 Carpenter Co., Geo. B., Chicago, Ill.  
 Leschen & Sons Rope Co., A., St. Louis, Mo.  
 Marion Malleable Iron Works, Marion, Ind.  
 Mockbee & Co., O. M., Cincinnati, O.  
 Roebling Sons Co., J. A., Trenton, N. J.  
 Upson-Walton Co., Cleveland, O.

#### COAL AND ORE CONVEYING MACHINERY

\*Ray City Dredge Works, Ray City, Mich.  
 \*Byers Machine Co., Ravenna, O.  
 \*Good Roads Mach'y Co., Kennett Square, Pa.  
 \*Hais Mfg. Co., Geo., New York.  
 \*Weller Mfg. Co., Chicago, Ill.  
 Bartlett & Snow Co., O. O., Cleveland, Ohio.  
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 Gifford-Wood Co., Hudson, N. Y.  
 Hayward Co., New York.  
 Hunt Co., Inc., C. W., West New Brighton, N. Y.  
 Jeffrey Mfg. Co., Columbus, O.  
 Lidgerwood Mfg. Co., New York.  
 Link-Belt Co., Chicago, Ill.  
 Mead-Morrison Mfg. Co., E. Boston, Mass.  
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For Heating and Applying under Pressure all varieties of Bituminous Materials, Hot or Cold, for Road Construction, Maintenance or Dust Laying.

Heat and volume under instant control of operator. Positive pressure produced by the Kinney Pump.

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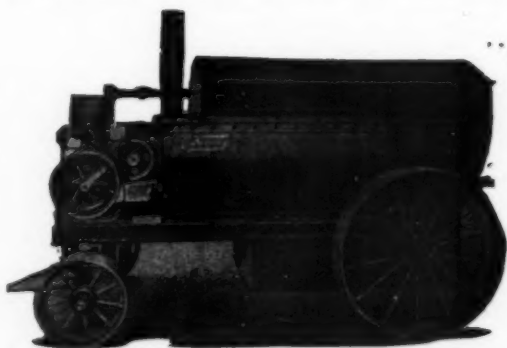


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11

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\*Union Water Meter Co., Worcester, Mass.  
Chapman Valve Mfg. Co., Indian Orchard, Mass.  
Glauber Brass Mfg. Co., Cleveland, O.  
Haydenville Co., Hampden, Mass.  
Mueller Mfg. Co., H., Decatur, Ill.

### COLUMN CLAMPS

Blaw-Knox Co., Pittsburgh, Pa.  
Hydraulic Steelcraft Co., Cleveland, O.  
Insley Mfg. Co., Indianapolis, Ind.  
Universal Form Clamp Co., Chicago, Ill.

### COMPRESSORS, AIR (See Air Compressors)

### CONCRETE FLOOR HARDENER

\*Truscon Laboratories, Detroit, Mich.  
Anti-Hydro Waterproofing Co., Newark, N. J.  
General Chemical Co., New York.  
General Fireproofing Co., Youngstown, Ohio.  
Granitax Corp., New York.  
Horn Co., A. C., Long Island City, N. Y.  
Master Builders Co., Cleveland, O.  
Sonneborn Sons, Inc., L. N. Y. "Lapidolith"

### CONCRETE MIXERS

\*Koehring Co., Milwaukee, Wis.  
\*Knickerbocker Co., Jackson, Mich.  
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Atlas Engineering Co., Milwaukee, Wis.  
Austin Machinery Corp'n, Chicago, Ill.  
Badger Concrete Mixer Co., Milwaukee, Wis.  
Chain Belt Co., Milwaukee, Wis.  
Construction Mach'y Co., Waterloo, Iowa.  
Contractors' Equipment Co., Keokuk, Ia.  
Fonte Concrete Mach'y Co., Chicago, Ill.  
Gray Iron Fdry Co., Reading, Pa.  
Jaeger Machine Co., Columbus, O.  
Judy Mfg. Co., Centerville, Ia.  
Lakewood Engineering Co., Cleveland, O.  
Lansing Co., Lansing, Mich.  
Oshkosh Mfg. Co., Oshkosh, Wis.  
Ransome Concrete Mach'y Co., Dunellen, N. J.  
Schramm & Son, Inc., Chris. D., West Chester, Pa.  
Smith Co., T. L., Milwaukee, Wis.  
Standard Scale & Supply Co., Pittsburgh, Pa.  
Truckmixer Co., Milwaukee, Wis.  
Worthington Pump & Mach'y Corp., New York.

### CONCRETE PILING. (See Piling, Concrete)

### CONCRETE REINFORCEMENT

\*Truscon Steel Co., Youngstown, O.  
American Steel & Wire Co., Chicago, Ill.  
Carnegie Steel Co., Pittsburgh, Pa.  
Concrete Steel Co., New York.  
Consolidated Expanded Metal Co., Braddock, Pa.  
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Electric Welding Co., Pittsburgh, Pa.  
General Fireproofing Co., Youngstown, O.  
Inland Steel Co., Chicago, Ill.  
Lockawanna Steel Co., Buffalo, N. Y.  
National Steel Fabric Co., Pittsburgh, Pa.  
Ryerson & Son, J. T., Chicago, Ill.  
Wickwire Spencer Steel Corp., Worcester, Mass.

### CONDENSERS

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Dean Bros. Steam Pump Wks., Indianapolis, Ind.  
Ingersoll-Rand Co., New York.  
Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.  
Wheeler Condenser & Eng. Co., Carteret, N. J.  
Worthington Pump & Mach'y Corp., New York.

### CONDUIT BODS

Bissell Co., F., Toledo, Ohio.  
Turbine Sewer Machine Co., Milwaukee, Wis.  
Waldo Bros. & Bond Co., Boston, Mass.

### CONDUITS

Fibre Conduit Co., Orangeburg, N. Y.  
Johns-Manville, Inc., New York City  
National Fireproofing Co., New York.  
National Metal Molding Co., Pittsburgh, Pa.  
Youngstown Sheet & Tube Co., Youngstown, O.

### CONTRACTORS SUPPLY DEALERS

See pages 82-91.

### CONTRACTORS' USED EQUIPMENT

\*Craven Co., Frank T., New York.  
\*Curtiss-Willis Co., Inc., New York.  
\*King, Philip T., New York.  
\*Peerless Iron & Metal Co., Detroit, Mich.  
\*Weiss, B. M., Philadelphia, Pa.  
\*Briggs, Inc., Marvin, Brooklyn, New York.  
Contractors' Mach. & Supply Co., Pittsburgh, Pa.

Gray Steel Prod. Co., New York.

King, Philip T., New York.  
Reading Engineering Co., New York.  
Zelnicker Supply Co., Walter A., St. Louis, Mo.

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\*Hais Mfg. Co., Geo., New York.  
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Gifford Wood Co., Hudson, N. Y.  
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Imperial Belting Co., Chicago, Ill.  
Jeffrey Mfg. Co., Columbus, O.  
Link-Belt Co., Chicago, Ill.  
Olson & Co., Sam'l, Chicago, Ill.  
Portable Mach'y Co., Passaic, N. J.  
Republic Rubber Co., Youngstown, O.  
Robins Conv. Belt Co., N. Y. C.  
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Webster Mfg. Co., Chicago, Ill.  
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### CONVEYORS, BUCKET

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\*Weller Mfg. Co., Chicago, Ill.  
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Guarantee Constr. Co., New York.  
Jeffrey Mfg. Co., Columbus, O.  
Link-Belt Co., Chicago, Ill.  
Mead-Morrison Mfg. Co., E. Boston, Mass.  
Olson & Co., Sam'l, Chicago, Ill.  
Republic Rubber Co., Youngstown, O.  
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Link-Belt Co., Chicago, Ill.  
Locomotive Crane Co. of America, Champaign, Ill.  
Marion Steam Shovel Co., Marion, O.  
McMyler Interstate Co., Cleveland, O.  
Northwest Engineering Works, Chicago, Ill.  
Orion & Steinbrenner Co., Chicago, Ill.  
Ohio Locomotive Crane Co., Bucyrus, O.  
Osgood Co., The, Marion, O.  
Overland Crane Co., Hammond, Ind.  
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Link-Belt Co., Chicago, Ill.  
Northern Eng. Works, Detroit, Mich.  
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Toledo Crane Co., Toledo, Ohio.  
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has ample power for every requirement of the service, and great durability. Operating and up-keep costs are unusually low.

A scarifier attachment can be installed on the roller at the factory or, with little trouble, in the field. The roller will then serve two uses—the scarifying attachment is raised and lowered by means of a steam cylinder which provides ample power for digging up the hardest surfaces, yet provides a cushion control that saves breakage.

Huber return flue boilers pass the heat through the water twice before it goes up the smokestack. They use it fully and completely and make sure that every atom of fuel is consumed. *Write for literature and prices.*

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## The Doughboy Jack

—the lightest jack made for its capacity. Weighs considerably less than other jacks of equal power, in some sizes less than half as much.

Sizes for 15 to 100 tons

Easy to operate; a 24-inch handle provides ample leverage. Has a positive check to prevent damage from over-extension. Made of steel throughout.

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Rock Drills—Pile Hammers—Lifting Jacks—Mining and  
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Southern Cressoting Co., Ltd., Sdell, La.  
Southern Paving Const. Co., Chattanooga, Tenn.  
Wyckoff Pipe & Cressoting Co., New York.

## CRUSHERS AND PULVERIZERS (See Rock Crushers)

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\*Good Roads Machinery Co., Kennett Square, Pa.  
\*Newport Culvert Co., Newport, Ky.  
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Dee Co., W. E., Chicago, Ill.  
Gallen Iron Works & Mfg. Co., Gallen, O.  
Hardesty Mfg. Co., The E., Denver, Colo.  
Lytle Culv. & Rd. Equip. Co., Minneapolis, Minn.  
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Russell Grader Mfg. Co., Minneapolis, Minn.  
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Wheeling Corrugating Co., Wheeling, W. Va.  
Wood & Co., R. D., Philadelphia, Pa.

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Madison Foundry Co., Cleveland, O.  
Mueller Mfg. Co., Decatur, Ill.  
Thompson-Fleming Co., Inc., Buffalo, N. Y.

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National Steel Fabric Co., Pittsburgh, Pa.  
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Barnes Tool Co., New Haven, Conn.  
Crane Co., Chicago, Ill.  
Erie Tool Works, Erie, Pa.  
Greenfield Tap & Die Corp'n., Greenfield, Mass.  
Reed Mfg. Co., Erie, Pa.  
Smith Mfg. Co., A. F., East Orange, N. J.  
Walworth Mfg. Co., Boston, Mass.

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\*Koehring Co., Milwaukee, Wis.  
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Worthington Pump & Mch'y. Corp., New York.

## CUTTING AND WELDING APPARATUS

Madison Co., Cincinnati, O.  
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Prest-O-Lite Co., Inc., New York.

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\*Byers Machine Co., Ravenna, O.  
\*Flory Mfg. Co., E., Bangor, Pa.  
\*Terry Mfg. Co., New York.  
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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Federal Bridge & Struc. Co., Waukesha, Wis.  
Inaley Mfg. Co., Indianapolis, Ind.  
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.  
Lidgerwood Manufacturing Co., New York.  
Lincoln Iron Works, Rutland, Vt.  
National Hoisting Engine Co., Harrison, N. J.  
Smith, Whitcomb & Cook Co., Barrie, Vt.  
Superior Iron Works, Superior, Wis.

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Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Lidgerwood Manufacturing Co., New York.  
Mueller Mfg. Co., H., Decatur, Ill.

## DERRICKS, REVOLVING

\*Terry Mfg. Co., New York.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Lidgerwood Manufacturing Co., New York.

## DERRICKS, STEEL

\*Terry Mfg. Co., New York.

American Hoist & Derrick Co., St. Paul, Minn.  
Austin Machinery Corp'n., Chicago, Ill.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Federal Bridge & Struc. Co., Waukesha, Wis.  
Hayward Co., New York.  
Inaley Mfg. Co., Indianapolis, Ind.  
Lakeside Bridge & Steel Co., N. Milwaukee, Wis.  
Lidgerwood Manufacturing Co., New York.  
Taylor Portable Steel Derrick Co., Chicago, Ill.

## DERRICKS, STEEL PORTABLE

\*Terry Mfg. Co., New York.  
Austin Machinery Corp'n., Chicago, Ill.  
Blaw-Knox Co., Pittsburgh, Pa.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Lidgerwood Manufacturing Co., New York.  
Taylor Portable Steel Derrick Co., Chicago, Ill.

## DERRICKS, TRAVELING

\*Bay City Dredge Works, Bay City, Mich.  
\*Byers Machine Co., Ravenna, O.  
\*Terry Mfg. Co., New York.  
American Hoist & Derrick Co., St. Paul, Minn.  
Austin Machinery Corp'n., Chicago, Ill.  
Clyde Iron Works Sales Co., Duluth, Minn.  
Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.  
Kayward Co., New York.  
Nat'l Hoisting Engine Co., Harrison, N. J.  
Orton & Steinbrenner Co., Chicago, Ill.

## DISINFECTING CHEMICALS

Barrett Co., New York.  
Electro Bleaching Gas Co., New York.  
Mathieson Alkali Works, Inc., New York.

## DISTRIBUTING PLANTS, CONCRETE

\*Koehring Co., Milwaukee, Wis.  
Archer Iron Works, Chicago, Ill.  
Inaley Mfg. Co., Indianapolis, Ind.  
Lakewood Engineering Co., Cleveland, O.  
Ransome Concrete Mach'y. Co., Danellen, N. J.

## DITCHING MACHINES (See Excavators, Ditch and Trench)

## DOORS AND SHUTTERS, STEEL ROLLING

Cornell Iron Works, New York.  
Kinner Mfg. Co., Columbus, O.  
Variety Mfg. Co., Chicago, Ill.  
Wilson Corp., J. G., New York.

## DRAFTING MACHINES

Universal Drafting Machine Co., Cleveland, O.

## DRAWING MATERIALS

American Blue Print Paper Co., Chicago, Ill.  
American Lead Pencil Co., New York.  
Dedance Mfg. Co., New York.  
Dietsgen Co., E., New York.  
Economy Draw. Table & Mfg. Co., Adrian, Mich.  
Gurley, W. & L. E., Troy, N. Y.  
Hamilton Mfg. Co., Two Rivers, Wis.  
Keuffel & Esser Co., Hoboken, N. J.  
Kolesch & Co., New York.  
Lutz Co., A., San Francisco, Cal.  
Spaulding-Moss Co., Boston, Mass.  
Weber & Co., F., Philadelphia, Pa.

## DREDGES

\*Bay City Dredge Works, Bay City, Mich.  
Bucyrus Co., South Milwaukee, Wis.  
Ellicott Machine Corp'n., Baltimore, Md.  
Hayward Co., New York.  
Lidgerwood Mfg. Co., New York.  
Marion Steam Shovel Co., Marion, O.  
Osgood Co., The, Marion, O.  
Stockton Iron Works, Stockton, Cal.  
Superior Iron Works, Superior, Wis.  
Vulcan Iron Works, Jersey City, N. J.

## DREDGES, DIPPER

\*Bay City Dredge Works, Bay City, Mich.  
American Steel Dredge Co., Fort Wayne, Ind.  
Austin Machinery Corp'n., Chicago, Ill.  
Bucyrus Co., South Milwaukee, Wis.  
Fairbanks Steam Shovel Co., Marion, O.  
Marion Steam Shovel Co., Marion, O.  
Osgood Co., Marion, O.

## DREDGES, HYDRAULIC

Bucyrus Co., South Milwaukee, Wis.  
Ellicott Mach. Corp., Baltimore, Md.  
Fairbanks Steam Shovel Co., Marion, O.  
Marion Steam Shovel Co., Marion, O.  
Morris Machine Works, Baldwinville, N. Y.

## DREDGING PUMPS AND ACCESSORIES

Erie Pump & Engine Wks., Medina, N. Y.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.



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For nearly four years the road illustrated above has stood up under the heaviest kind of traffic, both as to weight of loads and number of vehicles.

Truck loads of cement weighing from 20 to 30 tons passed regularly over this road—for months at a time, the daily average being 180 loads.

Today this road is in perfect condition, without one cent having been spent for repairs.

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#### PAVING ASPHALT "B"

was used in the construction of this road

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#### STANDARD OIL COMPANY

(INDIANA)

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## DRILLS, AYE

- \*Denver Rock Drill Mfg. Co., Denver, Colo.
- \*McKiernan-Terry Drill Co., New York.
- Chicago Pneumatic Tool Co., New York.
- Cleveland Pneumatic Tool Co., Cleveland, O.
- Cleveland Rock Drill Co., Cleveland, Ohio.
- Helwig Mfg. Co., St. Paul, Minn.
- Independent Pneumatic Tool Co., Chicago, Ill.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.

## DRILLS, CORE

- \*McKiernan-Terry Drill Co., New York.
- Dobbins Core Drill Co., Inc., New York.
- Ingersoll-Rand Co., New York.
- Standard Diamond Drill Co., Chicago, Ill.

## DRILLS, HAMMER

- \*Denver Rock Drill Mfg. Co., Denver, Colo.
- \*McKiernan-Terry Drill Co., New York.
- Chicago Pneumatic Tool Co., New York.
- Cleveland Pneumatic Tool Co., Cleveland, O.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.

## DRILLS, ROCK

- \*Denver Rock Drill Mfg. Co., Denver, Colo.
- \*McKiernan-Terry Drill Co., New York.
- Chicago Pneumatic Tool Co., New York.
- Cleveland Rock Drill Co., Cleveland, Ohio.
- Helwig Mfg. Co., St. Paul, Minn.
- Ingersoll-Rand Co., New York.
- Sullivan Machinery Co., Chicago, Ill.
- Wood Drill Works, Paterson, N. J.

## DRILLS FOR WELLS AND BLAST HOLES (See Well Drilling Machinery)

## DRUMS, HOLDING

- Blaw-Knox Co., Pittsburgh, Pa.
- Clyde Iron Works, Duluth, Minn.
- Dobbie Fdry. & Mach. Co., Niagara Falls, N. Y.
- Hayward Co., New York.
- Monaghan Machine Co., Chicago, Ill.

## DRYERS, ASPHALT AND CEMENT

- Allis-Chalmers Co., Milwaukee, Wis.
- American Blower Co., Detroit, Mich.
- American Process Co., New York.
- Atlas Dryer Co., Cleveland, O.
- Bartlett & Snow Co., C. O., Cleveland, O.
- Gummer & Son Co., F. D., Cleveland, O.
- East Iron & Machine Co., Lima, O.
- Ruggles-Coles Co., New York.
- Variety Iron Works, Cleveland, O.

## FOR MOTOR TRUCKS

- Company, Milwaukee, Wis.
- \*Littleford Bros., Cincinnati, O.
- American Truck Body Co., Inc., Martinsville, Va.
- Archer Iron Works, Chicago, Ill.
- Auto Truck Steel Body Co., Chicago, Ill.
- Columbian Steel Tank Co., Kansas City, Mo.
- Horizontal Hydraulic Hot Co., Detroit, Mich.
- International Motor Co., New York.
- Jennings Automatic Dump Body, Roanoke, Va.
- Lee Trailer & Body Co., Chicago, Ill.
- Pechstein Iron Works, Keokuk, Iowa.
- Simplex Mfg. Co., Conneautville, Pa.
- Van Dorn Iron Wks., Cleveland, Ohio.
- Wood Hydraulic Hoist & Body Co., Detroit, Mich.

## DUMP CARTS AND WAGONS, HORSE DRAWN

- \*Acme Road Machinery Co., Frankfort, N. Y.
- \*Austin Western Road Mch. Co., Chicago, Ill.
- Acme Wagon Co., Elmhurst, Pa.
- Arcadia Trailer Corp., Newark, N. Y.
- Austin Mfg. Co., Chicago, Ill.
- Eagle Wagon Works, Auburn, N. Y.
- Holsberg & Bro., Geo. H., Jeffersonville, Ind.
- Russell Grader Mfg. Co., Minneapolis, Minn.
- Stroud & Co., Omaha, Neb.
- Tiffin Wagon Co., Tiffin, Ohio.
- Watson Products Corp., Canastota, N. Y.

## DUST LAYING AND ROAD BINDER MATERIALS

- \*Standard Oil Co. (Indiana), Chicago, Ill.
- \*Texas Co., New York.
- Barrett Co., New York.
- Dow Chemical Co., Midland, Mich.
- Dustoline for Roads Co., Summit, N. J.
- Semet-Solvay Co., Solvay, N. Y.
- Texas Co., New York.

## DYNAMITE (See Explosives)

## EJECTORS, SEWAGE

- Pacific Flush Tank Co., Chicago, Ill.
- Yeomans Bros. Co., Chicago, Ill.

## ELECTRIC GENERATORS AND MOTORS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Fairbanks, Morse & Co., Chicago, Ill.
- General Electric Co., Schenectady, N. Y.
- Ideal Elec. & Mfg. Co., Mansfield, O.
- Triumph Electric Co., Cincinnati, O.
- Western Electric Co., New York.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## ELECTRIC LAMPS

- General Electric Co., Schenectady, N. Y.
- Westinghouse Lamp Co., New York.

## ELECTRIC LIGHTING PLANTS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Fairbanks, Morse & Co., Chicago, Ill.
- General Electric Co., Schenectady, N. Y.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.
- Western Electric Co., New York.

## ELECTRIC MOTORS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Crocker-Wheeler Co., Ampere, N. J.
- Fairbanks, Morse & Co., Chicago, Ill.
- General Electric Co., Schenectady, N. Y.
- Lincoln Electric Co., Cleveland, Ohio.
- Robbins & Myers Co., Springfield, O.
- Triumph Electric Co., Cincinnati, O.
- Wagner Elec. Mfg. Co., St. Louis, Mo.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## ELECTRIC SUPPLIES, METERS, ETC.

- Bissell Co., F., Toledo, Ohio.
- General Electric Co., Schenectady, N. Y.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## ELECTRIC TRANSFORMERS

- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- General Electric Co., Schenectady, N. Y.
- Kuhlman Electric Co., Bay City, Mich.
- Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.

## ELECTRIC WIRES AND CABLES. (See "Wire and Cable")

## ELEVATORS, BUCKET

- \*Austin Western Road Machy. Co., Chicago, Ill.
- \*Good Roads Mach'y Co., Kennett Square, Pa.
- \*Hais Mfg. Co., Geo., New York.
- \*Littleford Bros., Cincinnati, Ohio.
- \*Weller Mfg. Co., Chicago, Ill.
- Atlas Eng. Co., Milwaukee, Wis.
- Bartlett & Snow Co., C. O., Cleveland, Ohio.
- Chain Belt Co., Milwaukee, Wis.
- Fairfield Engineering Co., Lancaster, Ohio.
- Gifford-Wood Co., Hudson, N. Y.
- Jeffrey Mfg. Co., Columbus, O.
- Link-Belt Co., Chicago, Ill.
- Olson & Co., Sam'l, Chicago, Ill.
- Robins Conv. Belt Co., N. Y. O.
- Russell Grader Mfg. Co., Minneapolis, Minn.
- Webster Mfg. Co., Chicago, Ill.
- Worthington Pump & Mch'y. Corp., New York.

## ELEVATORS, CONTRACTING MATERIAL

- \*Byers Machine Co., Havana, O.
- American Hoist & Derrick Co., St. Paul, Minn.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Fairfield Engineering Co., Lancaster, Ohio.
- Inslay Mfg. Co., Indianapolis, Ind.
- Ransome Concrete Machy. Co., Danellen, N. J.

## ELEVATORS, FACTORY

- \*Weller Mfg. Co., Chicago, Ill.
- Otis Elevator Co., New York.
- Ridgway & Son Co., C., Coatesville, Pa.
- Spindel, J. G., Reading, Pa.
- Standard Conveyor Co., No. St. Paul, Minn.
- Webster Mfg. Co., Chicago, Ill.

## ELEVATORS, PASSENGER AND FREIGHT

- Haughton Elevator & Mach. Co., Toledo, Ohio.
- Otis Elevator Co., New York.
- See Elec. Elevator Co., A. B., New York.
- Warner Elevator Mfg. Co., Cincinnati, O.

## ENGINES, GAS AND GASOLINE

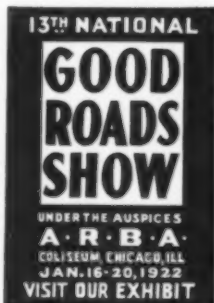
- \*Holt Mfg. Co., Peoria, Ill.
- Allis-Chalmers Mfg. Co., Milwaukee, Wis.
- Climax Engineering Co., Clinton, Ia.
- C. H. & E. Mfg. Co., Milwaukee, Wis.
- Chicago Pneumatic Tool Co., New York.
- Domestic Engine & Pump Co., Shippensburg, Pa.
- Fairbanks, Morse & Co., Chicago, Ill.
- Foss Gas Engine Co., Springfield, Ohio.
- Fuller & Johnson Mfg. Co., Madison, Wis.
- Gade Bros. Mfg. Co., Iowa Falls, Iowa.
- "New-Way" Motor Co., Lansing, Mich.
- Novo Engine Co., Lansing, Mich.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

THE SATISFYING EFFICIENCY OF GALION  
ROAD MACHINERY LIES IN THE FACT  
THAT IT IS BUILT RIGHT, DOES THE  
WORK RIGHT, AND PRICES ARE RIGHT.

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Road Scarifiers  
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Steam Road Rollers  
Tandem Motor Rollers  
Tandem Steam Rollers  
Crushed Stone Spreaders  
Gravel Spreaders

Cast Iron Culverts  
Corrugated Culverts  
Catch Basin Covers  
Gravel Screening Plants  
Gravel Loaders  
Rock Crushers  
Coal Unloaders  
Road Plows  
Road Drags  
Rooter Plows  
Drag or Slip Scrapers  
Fresno Scrapers  
Wheel Scrapers

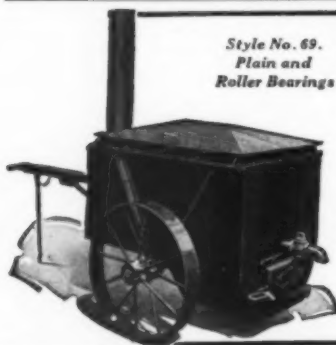
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Style No. 69.  
Plain and  
Roller Bearings

## LITTLEFORD TAR & ASPHALT HEATERS

Are Better—Much Better.

Made in Various Styles of Different Capacities. Send for Descriptive Literature.

Complete Equipment for Paving Contractors and Municipalities.

Pouring Pots and Asphalt Paving Tools. Tool Heaters.

Also the Andresen Road Repair Outfit.

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Sewer Pipe 3"  
to 36" and 2 to  
3 foot lengths  
Culvert Pipe  
Flue Lining  
Wall Coping  
Drain Tile  
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Fire Brick  
Fire Clay

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Our customers will tell you that this trade-mark stands for the best in quality, service and price. But that's not first hand information.

Let us prove it to you direct.

You can't tell how excellent the quality of our products, how fair the price and how ideal the service until you have actually placed an order in our hands for execution.

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**THE DELAWARE CLAY PRODUCTS CO.**  
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17

Universal Motor Co., Oshkosh, Wis.  
 Weber Engine Co., Kansas City, Mo.  
 Worthington Pump & Mch'y. Corp., New York.

**ENGINES, HIGH DUTY WATER-WORKS**  
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 De Laval Steam Turbine Co., Trenton, N. J.  
 Fairbanks, Morse & Co., Chicago, Ill.  
 Morris Machine Works, Baldwinville, N. Y.  
 Murray Iron Works Co., Burlington, Ia.  
 Worthington Pump & Mch'y. Corp., New York.

**ENGINES, OIL**

**DIESEL**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 Busch-Sulzer Bros.-Diesel Eng. Co., St. Louis, Mo.  
 Dodge Sales & Eng. Co., Mishawaka, Ind.  
 Fulton Iron Works Co., St. Louis, Mo.  
 McIntosh & Seymour Corp., Auburn, N. Y.  
 Nordberg Mfg. Co., Milwaukee, Wis.

**SEMI-DIESEL**

Advance Rumely Trencher Co., La Porte, Ind.  
 Anderson Fluidy & Mach. Co., Anderson, Ind.  
 Bessemer Gas Eng. Co., Grove City, Pa.  
 Buckeye Machinery Co., Lima, O.  
 Chicago Pneumatic Tool Co., Chicago, Ill.  
 De La Vergne Machine Co., New York.  
 Fairbanks, Morse & Co., Chicago, Ill.  
 Foos Gas Engine Co., Springfield, O.  
 Ingersoll-Rand Co., New York.  
 Midwest Engine Co., Indianapolis, Ind.  
 Miets Corp'n, New York.  
 Muncie Oil Eng. Co., Muncie, Ind.  
 Nordberg Mfg. Co., Milwaukee, Wis.  
 St. Mary's Oil Eng. Co., St. Charles, Mo.  
 Stover Steel Tank & Mfg. Co., Freeport, Ill.  
 Taylor Machine Co., Cleveland, O.  
 Weber Engine Co., Kansas City, Mo.  
 Worthington Pump & Mch'y. Corp., New York.

**ENGINES, PUMPING**  
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 American Gas Engine Co., Kansas City, Mo.  
 American Well Works, Aurora, Ill.  
 Dayton-Dowd Co., Quincy, Ill.  
 Deming Co., Salem, O.  
 Fairbanks, Morse & Co., Chicago, Ill.  
 Enterprise Mch'y. Co., Minneapolis, Minn.  
 Midwest Engine Co., Indianapolis, Ind.  
 Nordberg Mfg. Co., Milwaukee, Wis.  
 United Iron Works, Inc., Kansas City, Mo.  
 Weinman Pump Mfg. Co., Columbus, O.  
 Westinghouse Elec. & Mfg. Co., E. Pittsb'gh, Pa.  
 Worthington Pump & Mch'y. Corp., New York.

**ENGINES, STEAM**  
 Allis-Chalmers Mfg. Co., Milwaukee, Wis.  
 Duke Engine Co., Grand Haven, Mich.  
 Erie-Ball Engine Co., Pittsburgh, Pa.  
 Erie Pump & Engine Co., Medina, N. Y.  
 Filer-Stowell Co., Milwaukee, Wis.  
 Hardie-Tynes Mfg. Co., Birmingham, Ala.  
 Leffel Co., J., Springfield, O.  
 Morris Machine Works, Baldwinville, N. Y.  
 Murray Iron Works Co., Burlington, Ia.  
 Nordberg Mfg. Co., Milwaukee, Wis.  
 Sturtevant Co., B. F., Hyde Park, Boston, Mass.  
 Vilter Mfg. Co., Milwaukee, Wis.

**ENGINES, TRACTION**  
 \*Austin-Western Road Mch'y. Co., Chicago, Ill.  
 \*Holt Mfg. Co., Peoria, Ill.  
 Fairbanks, Morse & Co., Chicago, Ill.  
 Oliver Tractor Co., Knoxville, Tenn.  
 Phoenix Mfg. Co., Eau Claire, Wis.

**EXCAVATING MACHINERY. (See Names Under Excavators, also Steam Shovels)**

**EXCAVATORS, CARLEWAY**  
 \*Byers Machine Co., Ravenna, O.  
 Ball Eng. Co., Erie, Pa.  
 Blaw-Knox Co., Pittsburgh, Pa.  
 Bucyrus Co., South Milwaukee, Wis.  
 Lidgerwood Mfg. Co., New York.  
 Link-Belt Co., Chicago, Ill.  
 Marion Steam Shovel Co., Marion, O.  
 Smith Co., T. L., Milwaukee, Wis.

**EXCAVATORS, DITCH AND TRENCH**  
 \*Bay City Dredge Works, Bay City, Mich.  
 \*Byers Machine Co., Ravenna, O.  
 \*Pawling & Harnischfeger Co., Milwaukee, Wis.  
 American Holst & Derrick Co., St. Paul, Minn.  
 Austin Machinery Corp'n, Chicago, Ill.  
 Ball Engine Co., Erie, Pa.  
 Buckeye Traction Ditcher Co., Findlay, O.  
 Bucyrus Co., South Milwaukee, Wis.

Clyde Iron Works Sales Co., Duluth, Minn.  
 Economy Excavator Co., Iowa Falls, Ia.  
 Fairbanks Steam Shovel Co., Marion, O.  
 Hayward Co., The, New York City.  
 Keystone Driller Co., Beaver Falls, Pa.  
 Marion Steam Shovel Co., Marion, O.  
 Monaghan Machine Co., Chicago, Ill.  
 Osgood Co., Marion, O.  
 Parsons Co., Newton, Ia.  
 Russell Grader Mfg. Co., Minneapolis, Minn.

**EXCAVATORS, DRAG-LINE**  
 \*Bay City Dredge Works, Bay City, Mich.  
 \*Byers Machine Co., Ravenna, O.  
 \*Pawling & Harnischfeger Co., Milwaukee, Wis.  
 Austin Machinery Corp'n, Chicago, Ill.  
 Browning Co., Cleveland, O.  
 Bucyrus Co., South Milwaukee, Wis.  
 Clyde Iron Works Sales Co., Duluth, Minn.  
 Economy Excavator Co., Iowa Falls, Ia.  
 Gade, C. L., Iowa Falls, Iowa.  
 Hayward Co., New York.  
 Industrial Works, Bay City, Mich.  
 Link-Belt Co., Chicago, Ill.  
 Marion Steam Shovel Co., Marion, O.  
 Monaghan Machine Co., Chicago, Ill.  
 Osgood Co., Marion, O.  
 Parsons Co., Newton, Ia.  
 Smith Co., T. L., Milwaukee, Wis.

**EXPANDED METAL**  
 \*Truscon Steel Co., Youngstown, O.  
 Berger Mfg. Co., Youngstown, O.  
 Consolidated Expanded Metal Co., Braddock, Pa.  
 Corrugated Bar Co., Inc., Buffalo, N. Y.  
 Northwestern Expanded Metal Co., Chicago, Ill.

**EXPANSION JOINT MATERIAL**  
 \*Barber Asphalt Paving Co., Philadelphia, Pa.  
 \*Carey Co., Philip, Cincinnati, Ohio.  
 \*Pioneer Asphalt Co., Lawrenceville, Ill.  
 \*Texas Company, New York.  
 \*Truscon Steel Co., Youngstown, O.  
 \*Waring-Underwood Co., Philadelphia, Pa.  
 Barrett Co., New York.

**EXPLOSIVES**  
 Atlas Powder Co., Wilmington, Del.  
 Du Pont de Nemours & Co., E. I., Wilmington, Del.  
 Giant Powder Co., Cons., San Francisco, Cal.  
 Hercules Powder Co., Wilmington, Del.

**FENCING**  
 American Steel & Wire Co., Chicago, Ill.  
 American Post Iron Works, New York.  
 Cyclone Fence Co., Waukegan, Ill.  
 Frost-Superior Fence Co., Cleveland, O.  
 Indiana Steel & Wire Co., Muncie, Ind.  
 Kitzelman Bros., Muncie, Ind.  
 Pittsburgh Steel Co., Pittsburgh, Pa.  
 Stewart Iron Works Co., Cincinnati, Ohio.  
 Texas Cyclone Fence Co., Fort Worth, Tex.  
 Wickwire Spencer Steel Corp'n, Worcester, Mass.

**FILING EQUIPMENT, STEEL**  
 Art Metal Constr. Co., Jamestown, N. Y.  
 Berger Mfg. Co., Canton, O.  
 Econ. Drawing Table & Mfg. Co., Adrian, Mich.  
 Van Dorn Iron Works, Cleveland, O.

**FILTERS, OIL**  
 Bowser & Co., Inc., S. F., Fort Wayne, Ind.  
 Wayne Tank & Pump Co., Ft. Wayne, Ind.

**FILTERS, WATER**  
 American Water Softener Co., Philadelphia, Pa.  
 International Filter Co., Chicago, Ill.  
 N. Y. Continental Jewel Filtr. Co., Nutley, N. J.  
 Norwood Engineering Co., Florence, Mass.  
 Pittsburgh Filter & Eng. Co., Pittsburgh, Pa.  
 Roberts Filter Co., Darby, Pa.  
 Scaife & Sons Co., W. B., Pittsburgh, Pa.

**FIRE ALARM SYSTEMS**  
 Gamewell Fire Alarm Tel. Co., Newton Upper Falls, Mass.

**FIRE APPARATUS, MOTOR**  
 Ahrens-Fox Fire Engine Co., Cincinnati, O.  
 American-La France Fire Eng. Co., Elmira, N. Y.  
 Brockway Motor Fire App. Co., Cortland, N. Y.  
 Childs Co., O. J., Utica, N. Y.  
 International Motor Co., New York.  
 Prospect Mfg. Co., Prospect, O.  
 Seagrave Co., Columbus, O.  
 State Fire Engine Co., Indianapolis, Ind.

**FIRE EXTINGUISHERS, CHEMICAL**  
 American-La France Fire Eng. Co., Elmira, N. Y.  
 Childs Co., O. J., Utica, N. Y.  
 Cross Mfg. Co., C. J., Inc., New York.

\* Indicates that the manufacturer carries an advertisement. See index facing inside back cover.

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"A FLORY HOIST FOR EVERY PURPOSE"

Steam or Electric



THIS ONE—The Standard Double Drum Contractors Type—Sturdy in construction—Dependable in operation—made in all sizes from 5" x 6" to 12" x 14"—equipped with **Flory Cone Friction**, having positive releasing device—One of the many types listed in the **Flory Catalogue**—Sent free on request.

**Flory Cableways are Standard**—Used on large Construction work all over the world.

Special Cableway Catalogue sent to those interested.

**S. FLORY MFG. CO.**

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Monadnock Block  
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INC.

**HOISTS—CABLEWAYS—DREDGING MACHINERY**

## WOLVERINE MIXERS

A Knickerbocker Product



\$325.00

\$595.00

One Day Size

¶ The Wolverine Concrete Mixers successfully fill a big need right now, both in the building field and in the construction of side-walks, bridges and culverts, for a well made, low priced mixer.

¶ The special design of these mixers, together with the quantity built, permits us

to make them the desired weight for portability, and of sufficient strength to withstand the hard work they are subjected to on the job, and still sell them at exceedingly low prices.

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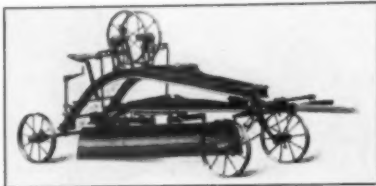
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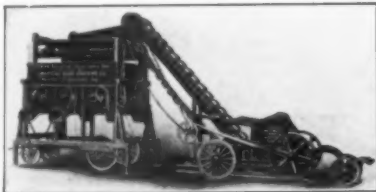
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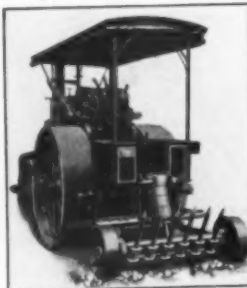
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Morris Machine Works, Baldwinville, N. Y.  
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Fairbanks, Morse & Co., Chicago, Ill.

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Builders Iron Fdry., Providence, R. I.  
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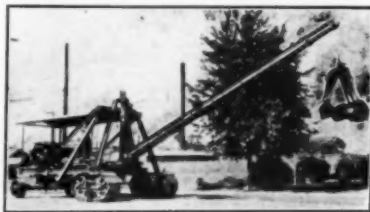
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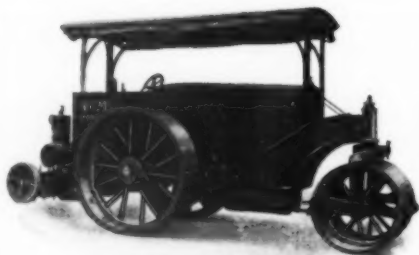
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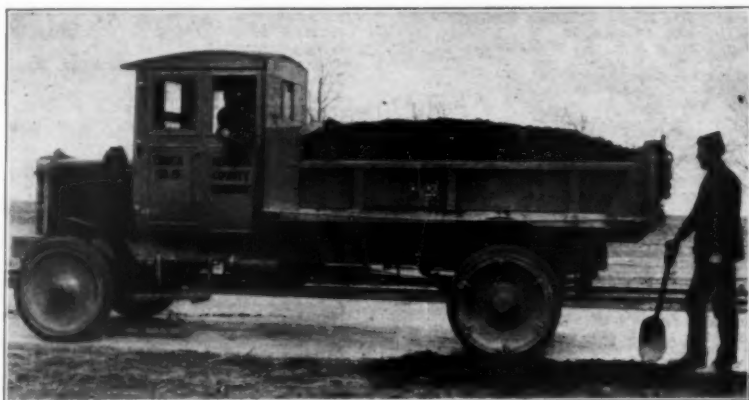
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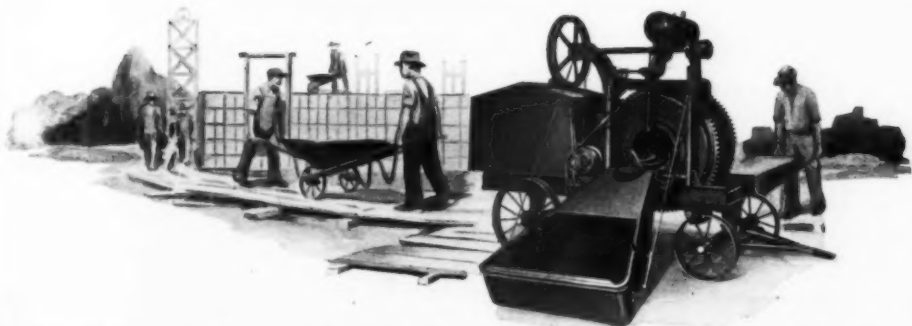
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A PURCHASING GUIDE FOR ENGINEERS, CONTRACTORS, PUBLIC OFFICIALS AND OTHER PURCHASERS  
OF CONSTRUCTION MATERIALS AND EQUIPMENT

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Vol. IV

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Unladen Chassis weight: Type F, 3600 lbs.; Type G, 3700 lbs.

## New 2 ton Heavy Duty Autocar

Overall capacity, 14,000 lbs. (Chassis, body and load)

Type H, 114-in. wheelbase, 4 cylinder motor . . . \$2950

Type K, 138-in. wheelbase, 4 cylinder motor . . . \$3075

Unladen Chassis weight: Type H, 5200 lbs.; Type K, 5350 lbs.

## New 5 ton Heavy Duty Autocar

Overall capacity, 22,000 lbs. (Chassis, body and load)

Type Y, 120-in. wheelbase, 4 cylinder motor . . . \$3950

Type B, 156-in. wheelbase, 4 cylinder motor . . . \$4100

Unladen Chassis weight: Type Y, 7200 lbs.; Type B, 7400 lbs.

THE AUTOCAR COMPANY, Ardmore, Pa., Established 1897

# Autocar

Wherever there's a road

When writing to advertisers, please mention the Contractors' & Engineers' Monthly

# Contractors' & Engineers' Monthly

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## Construction Costs—Part II

By W. N. Connor

Chief Cost Accountant, Aberthaw Construction Company, Boston, Mass.

### MATERIAL COSTS

1. *Purchase Order.*—The first form necessary, of course, for material records is the Purchase Order. This form is made to give all the necessary information and to show what the material is to be used for, which gives the cost man his distribution.

2. *Material Received Form.*—On receipt of the material, it is checked and entered on the Daily Material Received Form, showing the order number, vendor and material. On receipt of an invoice it is checked against this Material Received sheet for receipt of the goods.

3. *Invoice Record.*—When the invoice has been approved and passed for payment it is entered in the Invoice Record. There is a page for each vendor, and all payments made are entered, showing the invoice number, commodity and amount. In the right-hand columns are shown the check number with which the invoice was paid, date and voucher number. The last column shows the statement number on which the invoices appear when the month's expenditures are reported to the owner.

A page is also used for the weekly pay-rolls, and this register should check with the total of the Labor and Material Cost Books.

4. *Analysis of Estimate—Material.*—As stated previously, the Summary of the Estimate is divided into the Labor and Material Analyses. The Material Analysis includes all the material to be used on the job, with the quantities, unit prices and total money; also the subcontracts, insurance and field office equipment.

This analysis is used for all material cost comparisons and by the Purchasing Department in checking up their purchases and prices submitted.

5. *Material Cost Record.*—The Material Cost Record consists of a loose-leaf I. P. binder book. In it each item in the Material Estimate has a page, and the

estimated quantity, amount and unit are entered at the top of the sheet. After the invoices for material have been checked and paid they are entered in the Material Cost Record. The date of the invoice, vendor's name, kind and amount of material, and cost, are entered.

There is also a column headed "Outstanding Orders," and the amount of an order, as soon as it is placed, is shown in this column in pencil. As payments on these orders are made, they are entered in ink in the amount column, and the outstanding order figure reduced correspondingly. The

### Delayed Costs Are Worthless

Costs must be available at once to be effective in aiding economical handling of the work. Delayed reports of costs are practically useless in effecting any savings while the work is in progress. Proper cost reports have been compared to a fire-alarm system, in that they should not alone be able to give notice of some unusual condition, but equally lead the investigation to the seat of the trouble.

next column is for credits, and the last shows the total cost.

This book, then, contains all amounts paid for material on the job, and the total of this book and the labor cost record at the completion of the work must check with the total cost as shown in the bookkeeper's ledger. This book is the permanent record of the material costs, and is sent to the home office at the completion of the job.

6. *Material Cost Statement.*—In order to know how our purchases for material compare with the analysis of estimate, we make each month a Material Cost Statement similar to our Weekly Labor Cost Statement and show the overruns or savings on each item.

This form shows the item first, then the estimated and actual quantity, estimated and actual unit, and estimated and actual cost. In the next column are entered the outstanding orders. In the estimated quantity column is entered the total quantity as shown in the Analysis of Estimate and in the actual quantity column the quantity actually paid for. This statement is made to show as nearly as possible not only what the overrun is at the time the statement is made, but the final overrun or saving.

Of course, on the first three or four statements on a job that will take ten months to complete this is not possible, as all purchases will not be made or all contracts let, but in a very short time this comparison will indicate quite clearly the saving or overrun on the material costs that will show at the completion of the work. In addition to the outstanding orders being shown, we also estimate salvages and credits on plant, form lumber, etc., and include these figures in our statement.

Three copies of this monthly Material Statement are made. Two copies are sent the home office, one for the general superintendent and one for the Cost Department. The third copy is for the job files.

We have, therefore, in the home office each week a Labor Cost Statement and each month a Material Cost Statement.

7. *Tabulating Job Cost by the Graphic Method.*—A graphic chart is prepared to place before the general superintendent and construction manager the status of the job and enable them to quickly pick out those items which are above the estimate and need special attention. This chart shows what the final overrun or saving will be on the

various items if the unit obtained to date is maintained for the remainder of the work.

A valuable feature of this chart is that the quantity of work influences the tabulation, thereby showing that a small overrun on a very large quantity would result in a much larger money overrun at the end of the job than a large overrun on a small quantity of work. This would indicate that the large quantities of work to be performed should have the first attention in getting low unit costs. On our Labor Cost Statement you will remember we show the saving or overrun to date on the various items of work. Any seemingly small unit overrun on this labor statement would not always cause serious comment on the part of the job superintendent or management, but on these charts this small unit overrun, if it applied to a large quantity of work, would result in a very large money loss at the end of the job.

Plotting these costs each week, directly under the previous weeks, shows any variations and can be easily studied, compared and acted upon immediately before it is ancient history and too late to do any good.

8. *Final Cost Summary.*—At the completion of the job and after all bills have been paid, the final cost summary is worked up. The labor, material and plant units are shown separately and each divided into two or more items, and the total unit and total cost obtained.

These summaries are blue-printed and a copy furnished the Estimating Department. Attached to this summary is a Job History, giving information regarding:

- Personnel
- Prices paid for cement, sand, brick, etc.
- Nature of the soil
- List of subcontractors
- Wages paid labor
- How concrete was distributed, whether by buggy or chutes
- Number of towers and height, etc.

9. *Cost Comparisons.*—In order to stimulate interest among our foremen, we have been making up at the home office weekly comparative cost statements showing the units obtained on various jobs for similar classes of work. On this comparison we show the bogey unit allowed each job on the items compared, the quantity done, and the unit obtained on the job. Under each job we show the superintendent's and foremen's names, and the units below the estimate have a square around them, and the

foreman showing the best performance as compared with his own estimated unit has a star opposite his name. We find that these comparisons arouse considerable interest and some rivalry.

The quantity man, of course, has to keep in very close touch with the timekeeping and cost departments. He reports the quantities under the symbols as shown on the Analysis of Estimate, and must keep these right up to date in order to insure completing the cost statement promptly.

On small jobs the reporting of quantities will be done by the engineer, but on large operations one man will be assigned to this work alone. Without good, accurate quantities, up to date at all times, the cost data are, of course, practically useless.

Does it pay? You may say, "Well, this seems to be a good system, but does it pay?" I think it does.

On one job, recently, the brick costs were high compared with the estimated unit. It was found that masons were laying 1,100 to 1,200 brick a day, a good average for that particular class of work, so attention was given to the tending. It resulted in a rearrangement of the delivery of the brick to the elevator, and a very substantial saving on the unit per thousand. The costs showed this high unit at once, and afforded the means of rectifying it before it was too late.

On a large job in the South, last summer, the labor overrun was steadily increasing, and a detailed study of the costs was made. It was found that 60 per cent of the overrun was in the form work, and further, that 80 per cent of this 60 per cent was in two items. You can readily see that this gave to the management a big advantage in

showing them what to concentrate on. This they did, with the result that many thousands of dollars were saved, and the curve showing the overrun flattened out and remained practically so during the remainder of the work.

On one job the cost of laying maple flooring was running high. A man was set to watch the operation. The building had square interior as well as exterior columns, the corners of which had been chamfered by fitting a fillet in the column form. When the edge strip was fitted around these columns, a small triangular piece was fitted into the chamfered space. Time taken on this one operation showed that it added 20 cents per square over the whole floor, as there were four pieces fitted to each interior and two to each exterior column, or twelve to each bay. It was too late to make the maximum saving of 20 cents per square on this job, but by filling these holes with neat cement mortar the cost per square was reduced about 13 cents, and on the next similar building, by cutting off the fillet strip on a bevel just above the level of the edge strip, the full 20 cents per square was saved.

On another job the cost of laying floor plank was high. A time study was made and several reasons discovered for the high cost, one being the high cost of lumping, largely due to lack of proper planning. The cost prior to the time study was \$10 per thousand board feet. The time study showed that it could be done for \$5.25 if done at 100 per cent efficiency. The final average for this job was \$8.65, showing the effect of cost analysis.

ACKNOWLEDGMENT.—Reprinted from the *Journal of the Boston Society of Civil Engineers*.

### Fortify Against Carelessness

Human mortals will be careless. Two-thirds of our fire loss and resultant injuries and deaths are due to carelessness.

To change the national habit of carelessness is a slow process. Through education the next generation may become more careful. The present generation must accept carelessness as a fact and fortify against it, so as to reduce the loss of life, limb and property to the minimum.

Do not build to burn; use more fire-resisting building materials, now that there is but little difference in cost between these and combustible materials; above all, have a non-combustible roof covering, install furnaces and boilers on a brick or concrete base and provide a good clearance above and on all sides; build a good brick chimney with ample flue, lined throughout with terra cotta or fire clay flue lining; see that no woodwork is in contact with the chimney, firestop all partitions, walls and floors; get the most competent man you can to install gas piping and fixtures and electric light and power systems and devices;—in short, build so that fires cannot start readily, cannot spread rapidly, and can be extinguished easily.



## Oxy-Acetylene for the Contractor

**E**XTENSIVE as is the use of oxy-acetylene in the various branches of industry—and to-day it seems that oxygen and acetylene cylinders are in evidence everywhere—there are still very important opportunities for profitably employing either welding or cutting, or both, that are entirely overlooked in almost every place where the processes are even quite generally employed. This appears to be particularly the case in the contracting and construction fields.

Welding and cutting are essentially adapted to the speeding up of work and the whittling down of costs, and the alert contractor who makes a study of oxy-acetylene applications with reference to their possible bearing on his own problems, is in a fair way to safe ground in dealing with the narrow margin that divides certain profit from possible loss in much of the competitive bidding he must do. It has been said—and it does not seem unreasonable—that there is no contract of any considerable scope that can be completed as rapidly and as cheaply without oxy-acetylene as with it, even if it be used only for emergency repair of equipment.

Of course, the value of welding and cutting is obvious in any major breakdown of machinery, and that is what one hears of most, because it is spectacular. Let the blowpipe save even a few hundreds of dollars in a single instance by getting a broken machine back into commission quickly, and it is sure to be a subject of comment. Let

the saving be in the thousands, as not infrequently occurs, and it is published near and far. These examples are most interesting and instructive, but they are not fundamentally representative of the commonplace, every-day utility of welding and cutting. These processes to-day are more than emergency factors in industry. They have a place right on the job, and the superintendent or boss who realizes this and makes the most of it has a definite advantage over any competitor with whom he is otherwise on even terms, provided his competitor underestimates the value of these modern processes.

### Some Oxy-Acetylene Jobs

The contracting field is so broad that it would be difficult to adequately cover the specific applications for welding and cutting in the various branches; but there is not a contractor who cannot study with profit the general uses of these processes with a view to employing them to the greatest advantage on work in process. A few instances of welding jobs that have been handled in different lines of contracting are suggestive of what the blowpipe may mean to the contractor on certain work, and these are presented for such interest as they have; but only experience of the daily sort, where the contractor is determined to get the most out of welding and cutting equipment, will reveal the real possibilities of these processes. That is a matter for the contractor himself to develop; and the word "develop"



A QUICK WELDING REPAIR JOB ON A STEAM SHOVEL PART



MAKING PONTOONS FROM SHEET METAL BY WELDING

is used advisedly, for in the beginning the average contractor will honestly fail to see where he needs oxy-acetylene excepting for emergencies.

Before detailing some of the jobs alluded to above, it may be stated as a general fact that all contractors have to employ more or less heavy equipment. One kind of equipment that nearly all have to some extent in common is the motor truck. Whether a contractor owns one motor truck or a fleet of trucks, he will find welding and cutting the answer to maintenance and up-keep problems in this department. In all heavy machinery, strains in service are sometimes too great. Some part will either break or wear. The everlasting machine has never been built. Oxy-acetylene gets on the job, effects repair, and returns mechanism to service when it is broken, of course; but often it may be used to prevent the failure, exemplifying the proverbial "stitch in time." How often does your foreman tell you, "I've been more than half expecting that. If it had happened before we got started, or if it could have held out only a little longer!"

Sometimes a machine will give way without warning, but the keen and watchful man on the job usually gets an inkling of a machine's failure before it lets go. Right then is when oxy-acetylene can help most.

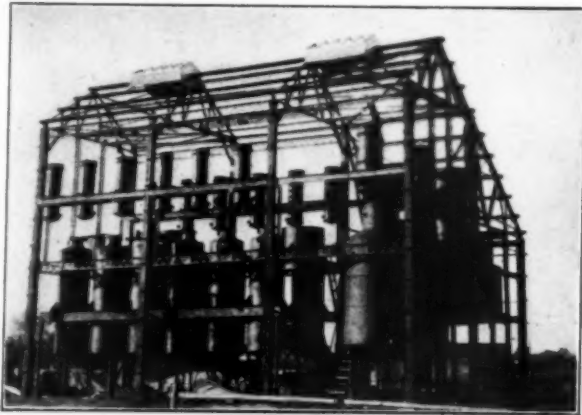
One of the illustrations shown in connection with these comments is of a steam shovel casting that was repaired by gas welding. The steam shovel is a heavy-duty device and is constructed, as every contractor knows, to stand up under severe working stresses. Even so, it is not uncommon for some working part to give way in the racking service to which the mechanism is put, and at such a time the oxy-acetylene torch is the first aid of the competent repair man. The picture shows the end sill casting of a large shovel after the repair. It is about 8 feet long, 3 feet high, and from 10 to 20 inches wide, with walls  $1\frac{1}{2}$  inches thick. The casting was cracked in a dozen or more places because of an overstrain. Some of the smaller fragments were lost. To have replaced the casting with a new one would have kept the equipment idle for weeks. By the use of

oxy-acetylene, the job was done in only a few days, and the shovel was thus back on the job without serious delay.\*

The steam shovel is a digger. The contractor does not always excavate, however. Sometimes he has to "make" ground. One way is by dredging with suction pumps. A large dredge and dock company, having entered into a contract to reclaim certain land in the Chicago district, had occasion to support a pipe line on pontoons for a considerable distance. In securing estimates on the building of the pontoons, it was found that they could be advantageously fabricated by oxy-acetylene welding, using as material steel sheeting, such as is commonly used in the manufacture of welded tanks. Accordingly, 95 steel shell pontoons, each 45 feet in length and 34 inches in diameter, were built.\*\* They were made in 15-foot sections and then welded together with dished heads in the ends. When completed, the pontoons were filled with air at 60 pounds (per square inch) pressure and floated. The seams proved in all instances to be water-tight, a property they retained throughout their service. In the illustration the pontoons are shown in the process of fabrication.

The use of the oxy-acetylene torch for demolition of steel-frame buildings is so common as to be very generally known, but the use of the blow-pipe in erecting structural steel is sufficiently rare to occasion special comment whenever it occurs. Even rarer is the refabrication of steel under the circumstances and in the manner recounted in the following instance:

A firm of contractors in the South not long ago erected a large turpentine still,



A STEEL STRUCTURE TO HOUSE (LEGAL) STILLS REFABRICATED BY OXY-ACETYLENE CUTTING AND WELDING

and the structural steel used in building the permanent housing for the plant was found, on its arrival, to be badly off-size and off-shape. Owing to the isolated situation of the plant, it was impracticable to return the steel to the mills and enter a re-order. Either the cost of the transportation or the delay would have been considerable; together they were prohibitive. In the emergency, the contractor, who had an oxy-acetylene outfit on the work, decided to use the blowpipe for refabricating the steel, cutting the over-lengths, welding necessary sections onto short lengths, burning rivet holes where needed, and heating members with the gas flame where reshaping was required. The work was accomplished with surprising despatch, and the structure was completed in less time than would have been required to get new material on the ground.

Recurring to the use of oxy-acetylene for demolition work, the contractor of to-day may well wonder how he ever got along without the cutting blowpipe in the years before it was developed. The answer is that a dozen years ago the demolition of buildings was confined almost entirely to structures having timber joists and beams. The Class A building was contemporaneous with the cutting torch, so that when the demand for greater buildings on old sites became insistent, there was a means at hand for clearing the way. But there is no need for exploiting the possibilities of oxy-acetylene cutting. Its spectacular qualities early advertised it to the imagination in such exploits as the removal of the sunken battle-

\* This job was shipped from a point in Pennsylvania to the Job Shop of the Oxweld Acetylene Company, at Newark, N. J., for welding. Had the contractor had his own welding and cutting outfit, the work could have been done on the ground, thereby saving time and cost of transportation, besides gaining important headway on the contract under execution.

\*\* This work was done by the Job Shop of the Oxweld Acetylene Company, in Chicago. That it also might have been done in the field by the dredge and dock company's own welders, is evident from the extensive pipe-line work that is successfully done in the field by oil and gas and water companies.

ship Maine, bit by bit, from Havana harbor, the clearing away of the wreckage of the great Quebec Bridge, and the dramatic rescue of the imprisoned passengers of the ill-fated steamship Eastland.

The case of welding is somewhat different. Even the heaviest welding is not spectacular in the sense that the lightest cutting is. There is no pyrotechnic display of sibilant sparks to dazzle the eye and proclaim the welder's work. All in all, it is rather plain stuff, like the homely virtues, and its worth is of the matter-of-fact order that excites little applause. The welding blowpipe would never raze a twenty-story building, but in a pinch it could come mighty near to erecting one. It is not a destroyer; it is a saver. And more and more it is becoming a builder. And it is because of its power to save and to build that contractors ought to give the subject of welding very serious consideration. Welding is not so highly technical or difficult of comprehension that the average intelligent person cannot grasp its applications and practices, and it is certain that he can get a lot of good out of it if he happens to be a contractor.

The few instances noted above—the steam shovel, the pontoons and the refabrication exploit—are only three in a field of applications that experience alone might number. Such applications as the retipping of tools, tempering, building-on new metal to worn places, reinforcing weak parts, should be obvious; and still these very things are often neglected with a welding outfit ready to hand. Why? It is because they are overshadowed. There is a tendency to pro-

crastinate in small things; a disposition to overlook the matter nearest to hand, and to leap into action only in the emergencies. In this respect welding is like every other element of the contractor's business—the contractor himself should inform himself sufficiently on the subject to see that he is getting the most out of it, or he should know that his foreman is so informed. It is a matter that will abundantly repay the contractor who will merely open his hand to a situation which is easy to understand and that is becoming more and more a part of the calculations of successful contractors everywhere to-day.

Wherever there are hoists, cranes, chains, cables, steam shovels, conveyors, ditchers, excavators, scrapers, dump-cars, rails, locomotives, dredges, hydraulic equipment, road or paving machinery—in fact, any considerable operating plant—the oxy-acetylene blowpipe is as necessary to up-keep and economy as other fundamental units of the equipment, and this view is held by practically every large contracting organization head in the business. But, as has been observed before, there are comparatively few of them that are getting the most out of welding and cutting. Those that are, however, are obtaining results of such value as to suggest the advisability of following their lead with as little delay as possible. There can be no denying that there is a great opportunity for the extension of oxy-acetylene application in the contracting field, among those who are actually using the processes, as well as among the ones who still depend on job shops for repairs.

### The New and The Old Methods of Heavy Hauling



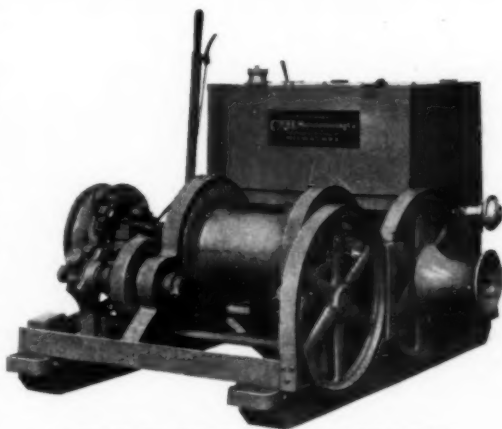
*Courtesy of Service Motor Truck Co.*

## A Motor-driven Hoist for Builders

**C**ARPENTERS and mason contractors cannot afford to let any means of effecting economy in construction methods slip by them unnoticed. Many contractors are finding, that a steam-driven equipment for hoisting lumber, brick and mortar is eating up profits too rapidly.

The C. H. & E. Manufacturing Company, Inc., 383 Clinton Street, Milwaukee, Wis., has placed on the market a builders' motor-driven hoist, which is recognized by contractors as one of the simplest and most serviceable.

The main or end frames are built of heavy ribbed castings. These end frames carry the main drum and clutch shafts, running in extra long boxes, lined with a high grade of anti-friction bearing metal. The bearing boxes are provided with large grease cups for lubrication. The gears are of heavy construction, running with very little noise and well protected with gear guards eliminating danger in operation. The motor pinion is of rawhide. All parts of the hoist are built upon the duplicate part system from standardized jigs and templets. This makes all parts interchangeable, an important feature that can be appreciated by the user. All hoists, whether engine- or motor-driven, are tested and made to develop the guaranteed load to be lifted, before shipping the outfit. The motors installed on these hoists are all standard makes, of national reputation. They are motors best adapted for hoisting service and will carry considerable overload without excessive heating or other damage. Motors for any current or voltage are furnished as specified, but it is important that the current be known before ordering. All the motor-driven machines are wired from the motor to the switch or starter,



A 4-CYLINDER GASOLINE REVERSIBLE HOIST

which is mounted securely on the machine, making it necessary only to connect to the line to put the machine into operation.

The clutches on this hoist are constructed to withstand the severe strains to which they are subjected day after day. They operate on the driving shaft instead of on the low-speed drum shaft. The pressure on the shoes required to transmit the load is considerably lower than if they operated on the low-speed shaft. Each clutch consists of three shoes which clamp a friction ring carried by the pinion which drives the drum gear. These shoes are lined with asbestos brake band lining, which can be easily replaced when worn out. Adjustment for wear on the shoes is readily made by loosening a nut and turning a toggle stud on the clutch shifter. The clutches are operated by the same lever.

### A Study in Cost Accounting

A county highway official in Virginia advertised for bids on a small grading job comprising 2,500 cubic yards of earth. Three bids were received: one for \$1.35 per yard, unclassified; one for \$1.00 per yard; and one for 80 cents per yard. The lowest bidder also agreed to take the job on a 10 per cent cost plus plan, if the highway official preferred, or better still, on a cost minus plan, using the 80 cents per yard as a basis for calculation.

The highway official agreed to bear the total actual expense of doing the work, including overhead and depreciation, and to allow the contractor \$10 per day for his

personal services in superintending the work. Then, using the 80 cents as a basis, the contractor was to receive in excess of his daily wage one-half of the difference of the total cost of the work per yard subtracted from the 80 cents.

The job was completed in twelve days. The total cost per cubic yard, including overhead and depreciation, was 38½ cents. The contractor received for his twelve days' work, not including rent for his teams and tools, the sum of \$638.75. The total cost to the highway official was 59¼ cents per yard, representing a saving under the lowest bid of \$518.75.—*Highway News Digest.*



## Asphalt Roofings Meet Urgent Need in Building Field

**W**ITH the advance in building methods which has taken place during the last few decades have come corresponding developments in the manner of roofing the many types of structures. Towering office buildings and hotels, extensive industrial establishments, pretentious churches and beautiful homes, as well as barns, garages and scores of other types of buildings, now are protected by durable, weather-tight roofs—the result of scientific research, analysis of the world's resources, and rigorous tests to determine the best materials.

Just as America has taken a leading part in the development of architecture, so it is leading in the perfection and refinement of materials which enter into the construction of buildings. Particularly is this true from the standpoint of roofing for homes, farm buildings and other structures intimately connected with every-day life.

Ready roofings—both roll goods and shingles—have been developed to such a degree that they stand high in popular favor and are in common use throughout the country. Economy, durability, adaptability and other factors recommend them.

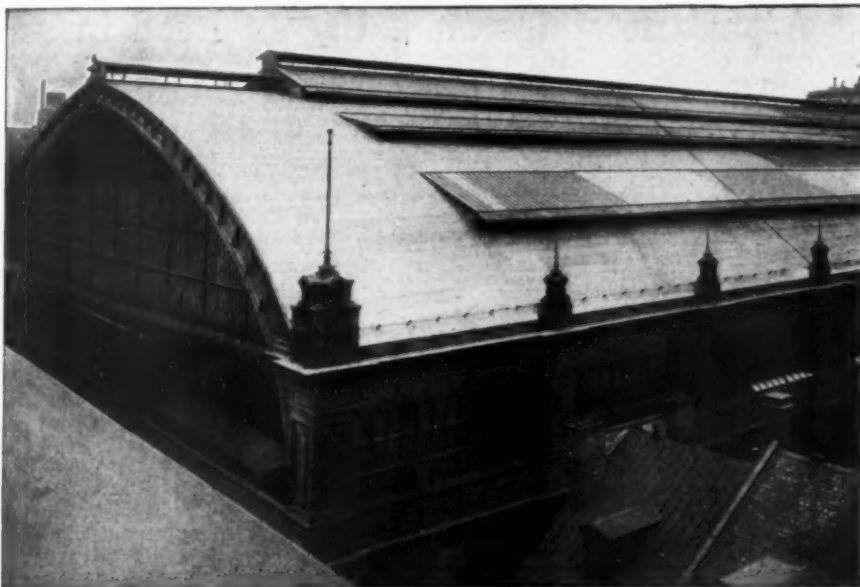
Trinidad Lake asphalt, a nature-made material, is used as the chief ingredient in the waterproofing agency of some of the highest types of ready roofings. The first known use of it as a waterproofing material was when Raleigh, several hundred years ago, used it to caulk his leaking vessels. However, natural asphalt, from deposits in Europe and other parts of the world, was known to, and employed by, the ancients as a waterproofing and preserving substance even in the days of Noah.

Imported first into this country for paving operations, more than forty-five years ago, Trinidad Lake asphalt soon demonstrated its wonderful weather-resisting qualities. Its possibilities for use in ready roofing were immediately realized, and since that time, cement made from it has been employed with marked success in Genasco roofings and shingles made by the Barber Asphalt Paving Company, Philadelphia, Pa.

For the expansive, flat coverings of industrial plants, railroad terminals, office buildings, and other structures, asphalt has been employed in built-up roofs, being laid without a mineral surfacing. It is claimed that the asphalt, sun-baked and wind-swept for ages in the deposit on



CLYDE STEAMSHIP COMPANY'S PIERS NOS. 1 AND 2, IN PHILADELPHIA, COVERED WITH ASPHALT ROOFING IN 1906 AND STILL IN PERFECT CONDITION WITH PRACTICALLY NO MAINTENANCE EXPENSE



TERMINAL OF THE PHILADELPHIA & READING RAILWAY COMPANY, PHILADELPHIA, PA.,  
COVERED WITH GENASCO READY ROOFING

the island of Trinidad will withstand exposure to the elements as no other material will.

Ready roofings are manufactured by many different companies employing varied processes. The general principle employed is the same, however, although the quality of the roofing varies with the quality of the waterproofing agency and the felt. In the manufacture of Genasco ready roofings, an all-rag felt of the highest grade is first thoroughly saturated. Then a heavy coating of Trinidad Lake asphalt cement is applied to each side of the felt sheet.

The base, saturant and coating for both roll roofings and asphalt shingles are identical. Asphalt shingles, however, and slate-surfaced roll roofing have imbedded in the upper coating of asphalt a layer of natural-color, crushed slate. This slate is applied while the asphalt coating is hot, and is firmly pressed into place. Consequently, the slate is held in a very firm grip.

Asphalt shingles are made in various forms, being cut from sheets of slate-surfaced material. The tremendous popularity which asphalt shingles have attained is due to their adaptability to every type of architecture, from the expensive manor house to the cosy, small bungalow, and to their durability and economy.

The coating applied to the underside of Genasco shingles forms the Sealbac feature, an important factor in insuring service and long life. Not only does the coating hermetically seal the saturant in the felt base, but when warmed by the sun, it tends to make the different layers of shingles adhere more closely to each other and to the roof. Consequently, these shingles virtually never curl or warp, and rain and snow find no means of entrance.

For warehouses, railroad sheds, barns and other buildings for which an attractive roof is not as important as for a home or a church, roll roofings, either slate or smooth-surfaced, have demonstrated ability to meet every requirement.

Trinidad Lake asphalt withstands not only heat and cold, rain and sun, but also gases and corrosive fumes. Roofings and shingles in which it is a component are therefore of exceptional service for roundhouses and terminals, chemical plants and laboratories and similar establishments.

With millions of dollars' worth of buildings of all types scheduled for erection, or already under way, the importance of applying roofs which beyond question will give complete protection cannot be overlooked.

### A Big Week for Contractors

American Road Builders' Association Convention, Chicago, January 17-20  
Associated General Contractors' Annual Meeting, Cleveland, January, 17-19

## A New Rapid Computing Machine

A RADICALLY improved computer, particularly adapted to contracting and engineering work, has been recently placed on the market by the Computer Manufacturing Company, 340 Sansome Street, San Francisco, Calif. This small machine provides an all-metal circular computer on the polyphase-duplex principle, but with simplified, longer and more complete scales. It is built like a transit, is claimed to be unaffected by heat, cold or dampness, and is convertible for use at a desk or for carrying in the pocket.

The Ross Rapid Computer, as it is called, is illustrated herewith. It consists of two scaled dials, set flush with each other and rotating concentrically. The dials are read by a hair-line engraved under the transparent arm, controlled by a thumb lock. The scales are graduated direct on heavy metal, fine as a transit but easy to read. A hollow conical center forms a precise bearing. The computer is 5 inches in diameter, so that its contact scales are  $12\frac{1}{2}$  inches long, like the upper scales of a 25-inch slide rule.

A magnifier adjustable in focus, radius and direction facilitates precise interpolations and makes readings appear larger than ordinary typewriting. To increase accuracy and reduce strain on hand and eye, a desk clamp is provided. This serves like a tripod for a compass and permits figuring with one hand while writing with the other. The pocket pouch for the computer and magnifier serves also as a loose-leaf book with Lefax fillers  $3\frac{3}{4} \times 6\frac{3}{4}$  inches and folds to  $5 \times 7$  for carrying in the pocket.

The scales of the computer are numbered plainly, 1150, 1160, 1170, etc., so that anyone can read them at first sight, without error. Eleven scales are provided, covering the rapid solution of numeric, exponential and trigonometric problems, including the measurement and conversion of horizontal and vertical angles, in degrees, mills or radians. When any problem is set under the arm of the computer, a long arrow shows the answer, and a short arrow shows the proof. If the problem involves three items, any two items are set under the arm, and opposite the third item is the answer. Thus with one setting it solves expressions like:



A CALCULATING MACHINE THAT FITS THE POCKET

$$7.63 \times 0.2479 \times 46.9 \text{ or } 1 \div \sqrt{\frac{3.649}{0.798}} \text{ or}$$

$$2.693 \times 0.0487 \times \tan 18^\circ 12' \text{ or}$$

$$\frac{\sin 72^\circ 43'}{\sin 49^\circ 28'}, \text{ or } \log \frac{0.497}{54.3 \times 0.02487}, 0.3897 \times 0.313$$

The key for the principal settings is given graphically on the arm in plain sight of the user. As the computer is circular, the answer never runs off the scale. In handling constants, the constant is locked and cannot shift accidentally, however long the operation. Trigonometric work is solved as simply as plain numbers without the necessity of turning the instrument upside down or end for end or figuring mentally complements or reciprocals of functions. This computer is used for figuring unit cost, quantities, percentages, monthly estimates, and especially for triangles, traverses and other trigonometric work.

### Who Makes Contractors' Pumps?

Frequently you are confronted with the question of who makes a specific kind of equipment. By consulting the "Where to Purchase" directory beginning on page 3 of the CONTRACTORS' AND ENGINEERS' MONTHLY your query is quickly answered.

## Removing Ruts and Holes from Pavements

### The Use of the Scarifier in Road Repair and Maintenance

**T**O-DAY the problem of road repair and maintenance is receiving quite as much attention as that of building new roads and streets. In order to effect the maximum economy and to realize the greatest returns on the original investment, stone roads of all types need regular and frequent attention and occasional resurfacing. The method of dumping new crushed stone in depressions in the road is obsolete. It has been found that time and traffic cannot be depended upon to consolidate such pieces of road. In order to make the new material bind with the old surface, the latter must be loosened, the particles separated and the new material rolled in.

Hand picking the surface of macadam roads is expensive and unsatisfactory. Plowing is dangerous and slow, and the work is too uneven to give good results. To help solve the problem, the Universal Road Machinery Company, Kingston, N. Y., designed its Porcupine scarifier. This is a simple machine, to be drawn by a steam roller or tractor, and has no belts, gearing or other mechanism to get out of order. It is merely drawn over the road, and the projecting teeth or picks dig up the surface, something after the manner of a harrow. The breaking-up process is accomplished for a width of about 2 feet at each trip. The disintegration is thorough, but the material is not injured or the separate pieces of stone broken. After reshaping the crown, the road may be rolled and top-dressed with fine stone, and the result will

be a new road practically perfect in every respect.

The depth of cut is easily regulated by means of the adjusting screw at each end of the scarifier. This screw raises or lowers the small adjusting wheel attached to the head of the sliding head. The wheel, running on the undisturbed surface just in front of the teeth, maintains the cut at the desired depth. The adjusting screws are placed between the steel channels at each end of the machine. This feature prevents injury to the screw and gives very strong construction. At the upper end of each screw is a latch for locking the adjustment.

An important feature in the operation of the machine is the slant of the teeth. When a scarifier is in operation, it is tipped forward more or less, depending upon the depth of the cut. In machines where the slant is less, the teeth assume a perpendicular position when operating. This makes it difficult to break the road surface. The slant of the teeth in the Porcupine scarifier is such that they have a forward pitch no matter what the depth of cut and therefore require less power to operate. It has also the effect of making the machine steadier. The teeth are made from a good grade of tool steel and carefully tempered. The wear is comparatively slight, and when the points become dull it is a simple matter to have them resharpened by a blacksmith. An extra set of teeth can be furnished, which can be used



A STATE HIGHWAY WITH RUTS AND HOLES BEFORE SCARIFYING AND RE-ROLLING



**A THOROUGH DISINTEGRATION OF THE ROAD SURFACE BY SCARIFYING IS THE FIRST STEP IN RESURFACING**

while the others are being redressed. The teeth are set in tapered holes which run clear through the frame, making it very easy to remove the teeth.

The scarifier operates in either direction, thus avoiding the necessity of turning the machine around at the end of each trip. The tractor or roller simply backs around and hooks to the other end, saving considerable time. The body

of the scarifier is hollow and has a lid attached, forming a convenient place for storing tools, chain and extra teeth.

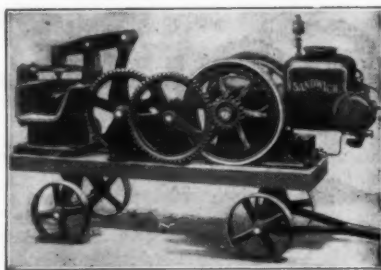
This scarifier will work close up to the curb. A special provision is made for shifting the axle, which allows the wheels to be moved over until the one on the right side is housed within a recess in the frame, eliminating all projections beyond the teeth.

## A Contractors' Pumping Outfit

**T**HE hand trench pump is rapidly being eliminated from the equipment of many contractors because of the present price of labor. The use of a gasoline pumping outfit is proving much more economical. Because of this demand, D. A. Hinman & Company, Sandwich, Ill., has placed on the market the Sandwich pumping outfit, which operates at a cost of 3 cents an hour, requires practically no attention while running, and will lift from 3,000 to 4,300 gallons of water per hour, depending on the conditions under which the pump is operated.

The gasoline engine is rated at  $1\frac{1}{2}$ -horsepower, but develops  $2\frac{1}{4}$  under brake horsepower test. The crank-shaft is of  $1\frac{3}{8}$ -inch forged steel. The normal speed of the engine is 500 revolutions per minute, which can be reduced about 33 per cent while the engine is running, by simply moving the speed-change lever. The engine has a large water hopper and galvanized iron fuel tank, located under the bed of the engine, easily accessible. The outfit is furnished with a high-grade oscillating magnet, eliminating the need of batteries.

The 3-inch diaphragm pump is especially designed for power use and is constructed so



**A PUMP BUILT TO OPERATE FOR 3 CENTS AN HOUR**

that the diaphragm rises and falls in a vertical straight line, eliminating all side strain on the diaphragm, which is altogether too common with some pumps of this type. The upper valve is so arranged that the water passes directly out of the spout, and can be removed without taking the pump apart. The whole pump is built extra strong to withstand the severe strain incident to heavy, rapid work, and operates



normal at 60 strokes per minute.

The complete pump and engine are mounted on portable hand trucks fitted with heavy, durable iron wheels and 3x6 white oak mounting

sills. The over-all dimensions of the outfit are 5 feet 3 inches long, 24 inches wide and 38½ inches high. It weighs complete, when mounted as shown in the illustration, 725 pounds.

## A Method for Protecting Motor Trucks from Overloading

Contractors Can Readily Measure Load on Trucks with Simple Device

ONE of the greatest evils in the use of the motor truck to-day is overloading. Overloading is disastrous to the life of the truck and injures the road, thus reacting on the pocketbooks of both the contractor and the taxpayer.

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., makes a portable device known as the Loadometer, by which it is possible to check up the load on motor trucks as loaded or when on the road, without the necessity of running the vehicle onto a platform scale. The device is in the nature of a hydraulic jack, as illustrated, and is placed under the axle of the vehicle suspected of being overloaded.

A pair of these jacks placed under the rear axle and jacking the rear wheels off the ground will give the reading of the actual weight lifted by the rear wheels. To determine the load on the front wheels, it is merely necessary to take a similar reading on the front axle, either by an additional pair of Loadometers or by using the same pair after noting the reading on the rear wheels.

These devices have been tested thoroughly in mechanical laboratories, and Professor Christy of Johns Hopkins University states that they have an efficiency of over 99.75 per cent. In fact, since their introduction about a year ago these devices have been adopted by road officials of fourteen states and by a great many county and municipal officials. They are also used by the U. S. Bureau of Public Roads.

In communities where loading laws are being



A PORTABLE MACHINE FOR MEASURING THE LOADS ON TRUCKS

enforced, the Loadometer is the only portable device that can be used for checking up these offenders on the road. It is merely necessary for a crew of one or two men using either a motor-cycle and side-car or a small automobile to patrol the road and weigh any truck—anywhere—that appears to be overloaded. The value of this device is readily seen, for overloaded motor trucks have doubtless caused more harm to our highway system than any other single cause, owing to the fact that they have not sufficient tire surface to distribute the load widely enough on the road.

## Wage Cuts in Massachusetts

Following an address by Charles R. Gow of Boston, President of the Associated Industries of Massachusetts, the Associated Contractors of Massachusetts declared by formal vote in December that wages in the building industry must be lowered in 1922. They voted also not to permit unions connected with the industry to dictate working conditions, and not to sign any

written agreement with the unions.

The contractors' organization was formed after building-trades strikes in Boston and other cities last fall. The Boston strike resulted in open-shop conditions in the building trades in that city. Mr. Gow assured the contractors that his Association would support them if matters came to a trial of strength with the unions.

## Paving Street Railway Areas and Heavy-Traffic Streets

Parkersburg, W. Va., Seeks Cooperation of Public Utilities in Reducing Pavement Openings

By William Kennedy

Executive Secretary, Board of Commerce, Parkersburg, W. Va.

THE city of Parkersburg, W. Va., has been going ahead vigorously with street paving improvements. Market Street, the main thoroughfare of the city, runs north and south. The Baltimore and

rail and is paved with 4-inch vitrified brick on a 9-inch concrete base with a 1-inch sand-cement cushion intervening. On either side of the street railway area, the street is finished with sheet asphalt on a concrete



MARKET STREET, PARKERSBURG, W. VA., DURING REPAIRING, LOOKING NORTH, SHOWING HOW THE CONTRACTOR SECURED GOOD PUBLICITY

Ohio Railway main line from St. Louis to New York is carried over the street by an overhead bridge.

Hitherto Market Street has carried a single track for street railway transportation with a half-block of double track for switching purposes opposite the City Hall. The new improvement, just finished, gives the street a double track from Third to Seventh Street. The car track area embraces, besides the space between the rails, a strip of 2 feet on the outside of either

base. There are five blocks or squares in the improvement on Market Street with a width of 38 feet between curbs.

The grading, curbing, concrete base, brick surface and construction of storm water sewers and inlets were done by the Kennedy Construction Company of Parkersburg, and the sheet asphalt was laid by the Federal Asphalt Paving Company, of Hamilton, Ohio. The entire improvement was completed in six weeks. About one month before paving operations started, all public

utilities and plumbers began to renew their water, gas and sewer lines. To facilitate this work, one block was closed at a time and all interested parties were notified to make their renewals and installations of lines at one operation. After the first block was completed, another was opened, and so on until the entire portion of the street to be improved was gone over carefully.

Koehring concrete mixers of the latest type were used. The brick was furnished by the Hocking Valley Brick Company, of Logan, Ohio. Atlas cement, Trinidad asphalt, Carey expansion joints, Ohio River sand and gravel, and asphalt sand from Sandusky, Ohio, were the materials used in the construction of the pavement. Steel rail was furnished by the Lorain Steel Company, and switches and other special track work by the Bethlehem Steel Company. Twin steel railway ties were used. The cost

of the improvement, borne by the street railway company, the property owners and the city, is slightly over \$45,000.

Single-track construction, identical with the foregoing, has recently been completed on Juliana Street and Seventh Street for a total distance of ten blocks. In connection with the improvement of these two streets the sides are to be resurfaced with 2½ inches of sheet asphalt, using the present old brick paving as a foundation. This plan has been given a thorough test on other streets carrying heavy traffic—Fourth, Fifth, Avery Streets and others—and has given general satisfaction. The estimated cost of the paving on Juliana and Seventh Streets is about \$56,000.

Plans and specifications for this work were drawn up by City Engineer Leland G. Merrill and carried out under his supervision.

## Structural Slate for Shower-Bath Stalls

**I**NVESTIGATION of the various types of shower stalls existing in different kinds of buildings, such as public comfort stations, industrial establishments, schools, colleges, and where batteries of showers are installed, has developed the fact that there are many slight variations from three basic sizes. By definitely fixing in advance the length of rooms or wall spaces to accommodate a fixed and definite size of shower stall, it is probable that considerable economy in the use of materials can be made without in any way affecting the construction of the building or its essential parts. The Structural Slate Company, Pen Argyl, Pa., through the cooperation of the majority of producers in structural slate in the counties of Northampton and Lehigh, Pa., has undertaken the standardization of structural slate for this type of work as well as for stairways, fittings, etc. The work of this company in standardizing structural slate products is not intended in any way to discourage the use of larger-size showers or smaller ones or special sizes, but the standardization recommended makes it possible to produce parts in advance and keep the warehouses filled for quick deliveries. Furthermore, it makes it possible to keep trained men in the quarries and busy on such productions throughout the entire year.

### Standardization

As a result of the investigation into the sizes of showers, three variations were finally adopted, namely, Size 1, 3x3 feet; Size 2, 3x3 feet 6 inches; and Size 3, 3 feet 6 inches by

3 feet 6 inches, all dimensions being from center line to center line. The smallest size for minors is not too crowded for adult use, and the largest size affords amply comfortable accommodation for any adult. One height was determined upon, namely 6 feet 6 inches from floor to top of slate. Above the slate is a nickel-plated brass bar for curtains and as a stiffener for partitions.

In order to meet the demand for showers in all classes of buildings, including industrial establishments, five types were decided upon. Type A consists of slate slabs forming backs, ends and partitions, with slate floors for use where space is limited and requirements as to splashing of water on floors are not exacting. This type insures the greatest economy in cost. Type B is similar to Type A, except that the addition of the curb at the bottom is a precaution against water from the shower leaking out over the floor. Type C is a development of Type B with stiles placed on either side of the front, extending to the top of the partition. Types D and E were developed to fill the requirements for a combination shower and dressing-room. Type D contains a separate dressing-room for each shower, and Type E has only one shower between each two dressing-rooms. In both types each dressing-room has a slate seat with a slate stile and curb between the dressing-room and the shower.

All the showers have been so arranged that they can be used either with or without the lead or metal pans. The showers may be raised on platforms, or the floors slightly depressed, without affecting the standardization.

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## ASSOCIATED GENERAL CONTRACTORS

### NEWS NOTES AND COMMENTS

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#### Cooperation in Industry

THE fundamental purpose of the Associated General Contractors is cooperation in the industry. In the midst of a world of antagonism between nations, between classes and interests in the same class, between labor and capital, between the ins and outs, between those who have and those who have not, the greatest motivating force in the world to-day is cooperation. It is the key to national and international relations, to sound industrial relations, to relations between man and man.

In these days of investigation, the greatest need in the construction industry is the restoration of public confidence—confidence in prices, in profits, and in men; and of these, men count for more than prices or profits, for the public knows that if men are right, prices and profits will be right also.

The Associated General Contractors has been founded on the principle that reason, rather than coercion, is the basis for the best relations between these interests; that cooperation must supplement competition if industry is to be conducted on a scale beyond that of small tradesmen. It has during the past two years of its existence, therefore, led in the organization of joint conferences between contractors and laborers, architects and engineers, for the consideration of their mutual problems. Important among the results of this policy stands the National Board of Jurisdiction of Awards and the Joint Conference in Estimating, whose report has just been issued. As the result of the old policy of antagonism of interest in these two matters alone, hundreds of thousands of dollars have been lost to the industry and to the public.

The seasonal nature of the construction industry is one of its biggest problems. It is in part inevitable. The letting of contracts, the making of wage agreements, the purchase of materials at the last minute of the spring just before the season opens, however, only make bad matters worse. As a result, some highway contracts, for example, will not be let until June and July. The

alleviation of these conditions is a matter involving every human element in the industry. It is not something which can be settled by competition. It can be settled only by cooperation. To help settle it, the Associated General Contractors of America is enlisting the assistance of all who are identified with the industry.

#### "The Constructor" to Replace the "Bulletin" of the Associated General Contractors

Beginning January, 1922, the *Bulletin* of the Associated General Contractors is published as *The Constructor—Buildings, Highways, Railroads, Public Works*. When the Executive Board of the Associated General Contractors of America decided in 1919 to publish a monthly magazine for the exchange of reports and information on construction, there was only one magazine issued by a contractors' organization which had attained a recognized standing outside of the membership of an association in the publication field; this was the *Bulletin* of the General Contractors Association of New York. In order to establish a strong national magazine, the General Contractors Association of New York merged the entire good-will, editorial service and business of its magazine with that of the national association and for the past two years has been entirely responsible for the development of the advertising in the Eastern territory in addition to supplying many editorial contributions relating not only to the New York association, but also to the entire construction industry.

The national magazine has now become fully established and its place in the construction industry has become recognized. Furthermore, there has arisen among many chapters of the national association a demand for a local publication representing local interests to supplement the national magazine. These publications are staunch allies of the national magazine, taking up the work started at headquarters in addition to their own.

### An Associated General Contractor's Biography

George C. Mason, with Charles B. Hurley, formed the Hurley-Mason Company in Portland, Ore., in 1904, and has been doing business ever since at the same address, except that the company now has offices in Seattle, Tacoma and Spokane. Starting when reinforced concrete was in its infancy, this company has grown up in that particular line of work. One of the most interesting pieces of work which they have done is the reconstruction of what is now the Electric Building in Portland, Ore. It was their problem to put in a new foundation under the one-story plant and build a nine-story building on top, without setting any columns in the power-plant and without stopping its operation at that time.



GEORGE C. MASON

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### Activities of Consulting Engineers

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J. N. Chester Engineers, Union Bank Building, Pittsburgh, Pa., have been employed by the city of Martins Ferry, Ohio, to make an investigation and report with a view to improving the municipal electric light and water-supply system.

Mees & Mees, Engineers, Charlotte, N. C., have been retained by the city of Shelby, N. C., for the design and supervision of the \$300,000 street improvements to begin in the early part of 1922.

A. W. K. Billings, Consulting Engineer, who during the war was in charge of naval aviation construction work ashore in Europe, has returned from Barcelona, Spain, and will be Construction Manager for the English and Canadian interests controlling large public utility companies in Mexico, Brazil and Spain. He is also Vice-President of the Canadian Engineering Agency, Inc., 115 Broadway, New York City.

E. S. Draper, Landscape Architect, Charlotte, N. C., is preparing a report on the proposed

development of a large suburban section of 400 acres for Henry C. Jones, Montgomery, Ala. He is also planning the development of grounds and a golf course for a new country club at Hickory, N. C., the estimated cost to be \$35,000. In addition, A. A. Shuford of Hickory, N. C., has retained Mr. Draper to develop a tract adjacent to the new country club for a high-class suburban residential district.

Benham & Mullergren, Firestone Building, Kansas City, Mo., are the consulting engineers for street improvements in District No. 2, Mangum, Oklahoma, where West Pierce Street, Maryland Avenue and Tyler Street, a total yardage of 11,640, are to be paved with asphaltic concrete laid on a cement concrete base.

George A. Johnson, 150 Nassau Street, New York City, has announced that because of the steady increase in amount and scope of his work, his offices have been moved to larger quarters. The offices are located at the same address in Suite 1121-1129. The new layout is designed to efficiently meet the executive demands of the business.

### Associated Pennsylvania Highway Contractors

The slogan, "A Dollar's Worth of Construction for Every Dollar of Road Bonds," was accepted as the aim of every contractor attending the Second Annual Meeting and Highway Construction Industry Conference of the Associated Pennsylvania Highway Contractors on December 15 and 16. The first day was devoted to committee reports on legislation, specifications, membership, labor, materials, transportation and publicity. The membership of the organization has grown 115 per cent within the last year. On the second day of the conference about 200 representatives of all branches of the industry listened to instructive addresses by well-known speakers.



# BOOKLETS FOR BUSY CONTRACTORS

The catalogs and pamphlets listed below are available for free distribution. Contractors and Engineers who check over these pages each month and write for such material as interests them, will find this a valuable means of keeping up to date on the subject of machinery and equipment.

## EXPANSION JOINTS FOR ROOFS

The need of expansion joints in concrete roofs is well described in literature which may be secured from the Philip Carey Co., 9 Wayne Ave., Lockland, Cincinnati, O., and which also describes Carey Elastite expansion joints.

## HOW TO USE GYPSUM PRODUCTS

An 82-page reference book prepared particularly for free distribution to contractors, architects and builders, has been issued by the United States Gypsum Co., 205 W. Monroe St., Chicago, Ill., under the title "The Red Book."

## TRENCH-EXCAVATING MACHINERY

The Parsons Co., Newton, Ia., will send to any interested contractor copies of its trench-excavating machinery bulletins free on request. These bulletins are well illustrated and contain interesting details and suggestions.

## ALL KINDS OF SHOVELS

The Pittsburgh Shovel Co., Pittsburgh, Pa., will send free on request a copy of its 36-page illustrated catalog, No. 5, covering its complete line of shovels, spades and scoops for all kinds of contracting work.

## AN EFFICIENT ROAD LEVELER

Full information and literature regarding the Schmeiser air control road leveler, which handles as much earth in one day as nine fresnos, may be secured by writing to the Schmeiser Manufacturing Co., Davis, Calif.

## HOISTING MACHINERY AND BUCKETS

Catalog No. 21, issued by Mead-Morrison Mfg. Co., East Boston, Mass., contains valuable data on hoisting machinery for quarrymen, contractors, bridge builders, etc., covering steam, gasoline, belt and electric hoists, suspension cableways and clam-shell and orange-peel grab buckets.

## PROFIT IN TRAILER HAULING

In its Bulletin Series 1026 CE the Trailmobile Co., 587 E. Fifth St., Cincinnati, O., gives details as to how the Trailmobile has been profitable in various fields of hauling.

## A CRAWLING TRACTOR CRANE

The Industrial Works, Bay City, Mich., is distributing free upon request its catalog No. 113 CE, illustrating and describing its new type BC crawling crane of 20,000 pounds capacity.

## BUCKETS—CLAM-SHELL, ORANGE-PEEL, DREDGE

Contractors desiring information regarding different types of buckets for various contracting services, including dredging, should write to the Vulcan Iron Works, Jersey City, N. J., and ask for its well-illustrated, 24-page bucket catalog.

## CAST IRON PIPE AND FITTINGS

In catalog B-51 the Lynchburg Foundry Co., Lynchburg, Va., lists in detail its cast iron bell-and-spigot pipe and fittings, cast iron flanged pipe and fittings, and gray iron castings of practically every description, in addition to reproducing a large amount of specially compiled material of advantage to the contractor.

## CONTRACTORS' HOISTING MACHINERY

In catalog 19 of the O. K. Clutch & Machinery Co., Columbia, Pa., contractors will find many interesting data regarding the value of O. K. hoisting machinery for operation with gasoline, oil or steam engines or by electric power.

## GRADING WITH WHEELED SCRAPERS

In special bulletin D 118, published by Smith & Sons Manufacturing Co., 1512 Guinotte St., Kansas City, Mo., is described the use and operation of Roytrac Unit wheelers, which increase daily excavating yardage by 50 per cent and reduce labor costs.

## DUMP-CARS FOR HANDLING EARTH AND STONE

The Western Wheeled Scraper Co., Aurora, Ill., in catalog No. 50 describes its complete equipment for the handling of earth and stone, including the well-known Western dump-cars and machinery.

## SCARIFIERS FOR SPRING ROAD JOBS

In general catalog No. 21 F, the Austin-Western Road Machinery Co., Chicago, Ill., describes its complete line of scarifiers and scarifier attachments for the road contractor.

## HEAVY-DUTY MOTOR TRUCKS

Full information regarding the new 5-ton heavy-duty Autocar, which is claimed to carry its rated load with less than 20,000 over-all weight, is described in detail in literature which may be secured from the Autocar Co., Ardmore, Pa.

## A ONE-MAN EXCAVATOR

The illustrated literature of the Bay City Dredge Works, 2622 Center Ave., Bay City, Mich., describes in detail the features of the Bay City one-man excavator, a light-weight, low-priced, economical digger for clay, sand and gravel pits.

## STANDARD AUTO CRANES

The Byers Machine Co., 480 Sycamore St., Ravenna, O., in its well-prepared bulletins describes in detail the advantages of the Byers Model "10" full-circle auto crane.

## UNIVERSAL CAST IRON PIPE

The advantages of a cast iron pipe in which there are no bell holes and in which no calking is needed and no packing used is described in detail in the literature of the Central Foundry Co., 90 West St., New York City.

## AN ALL-ROUND TRACTOR

Full details, a complete description, and specifications of the Cletrac, a small tractor of innumerable uses in the contracting field, may be secured from the Cleveland Tractor Co., 19011 Euclid Ave., Cleveland, O.

## PNEUMATIC ROCK DRILLS

In Bulletin B-5 the Denver Rock Drill Mfg. Co., Denver, Colo., describes in detail the effectiveness, utility and design of Waugh "Clipper" drills for all kinds of rock work.

## A TRACTION STEAM SHOVEL

The 14-ton, all-steel Keystone excra ator for use in road grading, trenching, back-filling, cellar digging, pit mining, loading, unloading and handling materials, is described in detail in the literature of the Keystone Driller Co., Beaver Falls, Pa.

## A ROAD OIL HEATER AND DISTRIBUTOR

The Kinney Manufacturing Co., 3529 Washington St., Boston, Mass., will send copies of its catalog describing the Kinney auto heater and distributor for applying bituminous material, hot or cold, to roads.

## HUSTLING CONCRETE WORK

The Dandie Catalog No. D-6, issued by the Koehring Co., Milwaukee, Wis., gives data and figures on the use of Dandie mixers on building construction jobs that will be of interest to the general contractor.

**STEEL WHEELBARROWS**

Bulletin No. 101, published by the Akron Barrow Company, Cleveland, Ohio, describes in detail Akron wheelbarrows, charging barrows and concrete carts.

**A CNE-CAE ASPHALT PLANT**

The East Iron and Machine Co., Lima, O., will send to paying contractors a copy of its illustrated booklet covering the Merriam one-car steam melting asphalt plant, in which all the melting is done by steam heat.

**ROAD-BUILDING MACHINERY**

The latest 58-page colored catalog of the Russell Grader Manufacturing Co., Minneapolis, Minn., contains many valuable descriptions of the uses of Russell road-building and earth-handling machinery.

**SEGMENT BLOCKS FOR SEWERS**

Full information regarding the construction of segment block sewers and special blocks for this work may be secured from the Robinson Clay Products Co., Akron, O.

**A MOTOR-DRIVEN HOIST FOR BUILDERS**

The C. H. & E. Manufacturing Co., Inc., 384 Clinton St., Milwaukee, Wis., has placed on the market a builders' motor-driven hoist, described in detail in literature which contractors may secure free on request.

**ASPHALT ROOFING**

The value of Genasco roofing for roofs which must withstand weathering for a long period of years may be secured from the Barber Asphalt Paving Co., Philadelphia, Pa.

**A PAVEMENT SCARIFIER**

The Universal Road Machinery Co., Kingston, N. Y., in its recent literature describes in detail the advantages of its Porcupine scarifier, which is particularly adapted for ripping up ruts and holes in old pavements under reconstruction.

**A GASOLINE TRENCH PUMP**

A gasoline trench pump capable of handling 3,000 to 4,300 gallons of water per hour is described in detail in the literature of D. A. Hinman & Co., Sandwich, Ill.

**CHECKING UP TRUCK OVERLOADING**

The Loadometer, a readily portable device for weighing trucks on the road or on the job, is described in detail in the literature of the Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md.

**STRUCTURAL SLATE FOR BUILDINGS**

The Structural Slate Co., Pen Argyl, Pa., has published a number of interesting booklets on the various uses of structural slate, which it will be glad to send to building contractors and others contemplating the use of this material.

**REDUCING COSTS OF ROAD MAINTENANCE**

Full information regarding the uses of Tervia in road maintenance and construction, and the value of reduced rates on tank car shipments, may be secured by writing to P. P. Sharples, General Tervia Dept., The Barrett Co., 40 Rector St., New York City.

**MOTOR TRUCKS FOR BUILDING CONTRACTORS**

Full information regarding the use of motor trucks for building contractors will be found in the literature of the Standard Motor Truck Co., Detroit, Mich.

**LOCOMOTIVE CRANES**

The Browning Co., Cleveland, O., in its well-illustrated 48-page catalog, not only gives the technical details and advantages of Browning locomotive cranes, but, in addition, illustrates many of the difficult jobs which these cranes have successfully handled.

**NEW PNEUMATIC TOOL CATALOG**

The Dayton Pneumatic Tool Co., Dayton, O., has just issued a new catalog, No. 21-D, describing its complete line of pneumatic riveting and chipping hammers and sand rammers, which will be of value to contractors using this type of tool.

**EQUIPMENT FOR PAVING AND ROAD BUILDING**

Booklet No. 17, issued by the Joseph Honhorst Co., 1016-1020 West Sixth St., Cincinnati, O., contains a complete listing of Honhorst contractors and municipal equipment for asphaltic road work.

**OXY-ACETYLENE FOR CONTRACTORS**

Full information regarding the advantages and varied character of oxy-acetylene welding in the contracting field may be secured from R. C. Rohrbacher, 30 East 42nd St., New York City.

**ROAD-BUILDING EQUIPMENT**

A complete line of road-building equipment for the contractor and road builder, which is sold direct from the factory to the customer, is listed in the catalogs of the Galion Iron Works & Mfg. Co., Galion, O.

**AN INDUSTRIAL RAILWAY CATALOG**

With the increasing use of industrial railway equipment on road jobs many contractors will be interested in securing the general road catalog No. 100, issued by the Koppel Industrial Car & Equipment Co., Koppel, Pa.

**BATCH BOXES, STEEL CARS, PORTABLE TRACK**

The Light Railway & Equipment Co., Commercial Trust Bldg., Philadelphia, Pa., will send full details regarding the complete line of steel cars, batch boxes, locomotives and portable track for industrial railways for concrete road construction.

**AN ALL-ROUND JACK**

Bulletin 29, issued by the McKiernan-Terry Drill Co., 19 Park Row, New York City, gives full details regarding the Doughboy jack, which is claimed to be the lightest jack made for its capacity for all kinds of contracting work.

**EVERLASTING CULVERTS**

The lasting qualities of Newport corrugated metal culverts are described in detail in the illustrated literature of the Newport Culvert Co., Inc., 542 West 10th St., Newport, Ky.

**CLAM-SHELL BUCKETS**

Material-handling contractors interested in a speedy, dependable clam-shell bucket for handling all types of bulk material should get in touch with the Owen Bucket Co., 418 Kirby Bldg., Cleveland, O., and secure its latest bulletin.

**NEW FACTS ON POWER SHOVEL**

The Excavating Machinery Div., Pawing & Harnischfeger Co., Milwaukee, Wis., will send full details regarding the new P & H gas shovel, which is one-man-operated and which eliminates water and fuel troubles, to anyone interested in excavating and grading.

**INDUSTRIAL STEAM LOCOMOTIVES**

Full details regarding steam locomotives built for long service and low up-keep, with simplicity in design, may be secured by writing to the H. K. Porter Co., Pittsburgh, Pa.

**CRANES AND DERRICKS**

Full information regarding Terry cranes and derricks, which have been standard for many contractors for a quarter of a century, may be secured from the Terry Manufacturing Co., Grand Central Terminal, New York City.

**STEAM-SHOVEL SERVICE**

In its latest bulletin, The Thew Shovel Co., Lorain, O., describes the Type O Thew power shovel, which is capable of working in frozen earth and can readily handle boulders and other difficult material.

**MATERIAL-CONVEYING MACHINERY**

Well-illustrated, instructive catalogs describing the complete line of conveying and power-transmitting machinery made by the Weller Manufacturing Co., 1820-1856 N. Kostner Ave., Chicago, Ill., may be secured free on request.

**BODIES AND HOISTS FOR TRUCKS**

The Heil Co., 1243 26th Ave., Milwaukee, Wis., in its catalog No. 120, gives specifications on bodies and hoists for all makes of trucks for all kinds of contracting service.

**STEAM AND ELECTRIC HOISTS**

The Flory standard double-drum contractors' type hoists, made in sizes from 5 x 6 inches to 12 x 14 inches, are described in detail in the catalogs of the S. Flory Mfg. Co., Bangor, Pa.

**GENUINE "PENNSYLVANIA" CEMENT**

Contractors who are familiar with the high quality of "Pennsylvania Brand" Portland cement should keep in mind the fact that "Pennsylvania" cement is manufactured solely by the Pennsylvania Cement Co., whose New York office is at 131 East 46th St., where inquiries for prices may be addressed.

**TOOLS FOR REMOVING CONCRETE FORMS**

Anderson Bros. Manufacturing Co., Rockford, Ill., makers of three types of wrecking bars for removing concrete forms, wrecking buildings, moving crates, etc., will send on request its folder describing these bars in detail.

**A HEAVY-DUTY GASOLINE ENGINE**

Full information regarding a dependable heavy-duty gasoline engine for all types of contracting work will be found in the catalog of the Climax Engineering Co., Clinton, Ia.

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## CONTRACTORS', ENGINEERS' AND MANUFACTURERS' NOTES

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### Koppel Opens K. C. Office

The Koppel Industrial Car & Equipment Company, Koppel, Pa., has opened a new district office at Kansas City, Mo., in the Railway Exchange Building. Harry C. Kraft, formerly with the New York office, has been appointed Manager of the Kansas City district.

### Wood in Charge of Philadelphia District

Alan A. Wood, formerly connected with the Providence plant of the Builders Iron Foundry and the Diamond Machine Company, associated companies, as engineer and in a sales capacity, is now located in Philadelphia as Sales Manager of that district.

### Cement Gun Opens Holland Office

The Cement Gun Company has announced that J. C. Townley, formerly manager of the Pittsburgh office, left in October for Holland, where he will be General Manager of the International Cement Gun Company in Utrecht. This company will handle the foreign business of the Cement Gun Company, Inc., with the exception of Canada, Mexico and Cuba.

### Structural Service Bureau Moves

The Structural Service Bureau, an organization for increasing safety, efficiency and productivity in the building industry through a better understanding of the characteristics, manufacture and utilization of materials, equipment and devices, has removed from the Estey Building to the Otis Building, 112 South Sixteenth Street, Philadelphia, Pa. The increased space and facilities at the new location will enable the Bureau to cooperate with industries and producers in standardizing processes, parts, sizes and arrangements and in eliminating waste of materials and labor and, further, in placing carefully prepared statistical data concerning their programs and products before architects, engineers and the consuming public. D. Knickerbacker Boyd, Victor D. Abel, Francis A. Gugert, A. Lynwood Ferguson and associates make up the executive personnel of this Bureau.

### Sawyer with Universal Crane

George L. Sawyer, formerly sales manager of material-handling machinery for the Barber-Greene Company, Aurora, Ill., has been appointed to represent the Universal Crane Company in the New York field, with offices at 141 Center Street, New York City.

### Exhibit for Building Contractors

The Architectural League of New York, 215 West 57th Street, held a large exposition last year for an entire month in the south wing of the Metropolitan Museum. This exhibit crystallized the idea of a greater coordination of the arts, trades and sciences, which go to make the completed structure. For that reason, an aggressive policy has been adopted for creating a greater spirit of cooperation between the various contractor and engineer concerns and the architect, and vice versa, so that they shall mutually understand what each can produce and the advantages the designer will get by having this knowledge. The results of this getting together should prove of great benefit, not only to contractors and engineers and architects, but also to the general public, and it is with this view that periodical exhibitions are held in the League's room at 215 West 57th Street, where various works of contractors and engineers will be displayed. These exhibits are open not only to members of the architectural profession, but also to the public at large. The dates of the various exhibitions may be secured from the Secretary, Russell F. Whitehead.

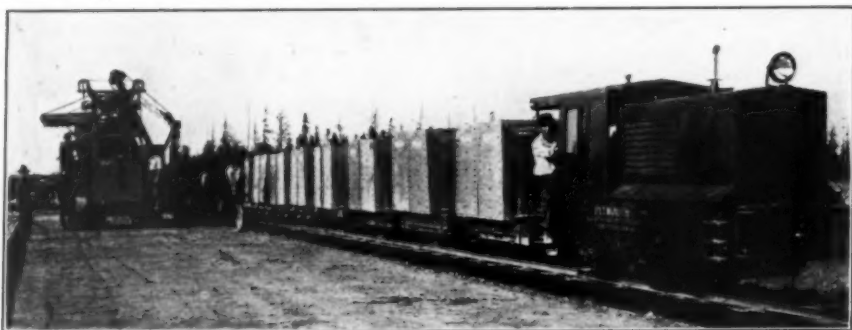
### Portland Cement Association Membership

At the final session of the Annual Meeting of the Portland Cement Association, which was held December 12-14 at the Biltmore Hotel, New York, the Association's constitution and by-laws were amended so as to make membership in the Association "contingent upon member's product meeting the standard specifications for Portland cement adopted by the United States Government and the American Society for Testing Material."

### New Cletrac Advertising Manager

The announcement has been made by the Cleveland Tractor Company, Cleveland, Ohio, that Earl B. Stone has been appointed Advertising Manager, effective December 15. After 2½ years with this company, serving as Sales Representative, Assistant Advertising Manager and District Sales Manager, Mr. Stone is well qualified to assume his new duties. His former advertising experience included work with the General Fireproofing Company of Youngstown, Ohio, and the National Acme Company of Cleveland, Ohio.

## Equipment for the Highway, Sewer and Building Contractor



**A PORTION OF THE MILLER TRUNK HIGHWAY SYSTEM RUNNING FROM DULUTH, MINN., UNDER CONSTRUCTION**

The Grant-Smith Company, Spokane, Wash., and St. Paul, Minn., purchased the Plymouth locomotive and Rex mixer shown, from William H. Ziegler Company, Inc., Minneapolis, Minn. The batch boxes are made by the Western Wheel Scraper Company

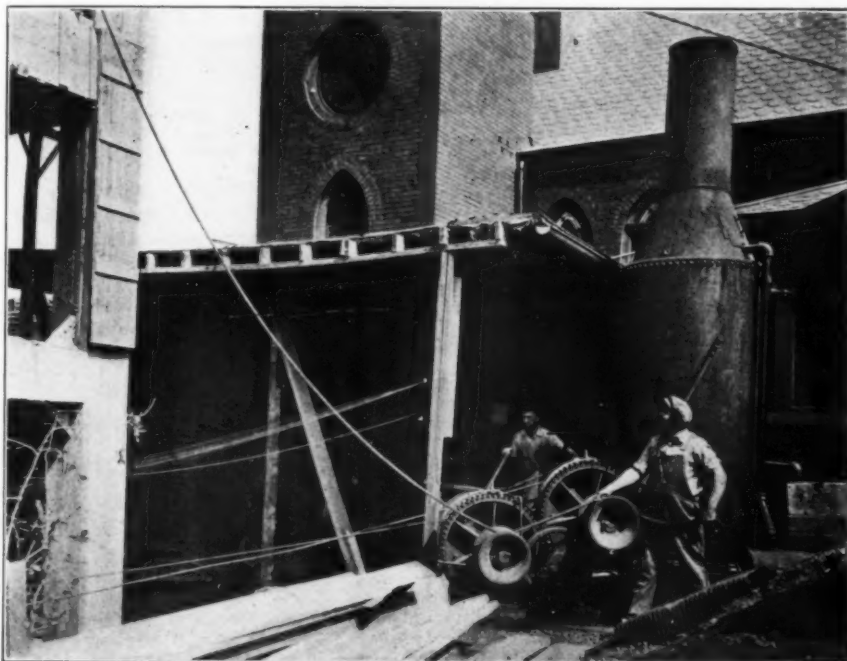


**BACK-FILLING ON THE LANZO ROAD SEWER, DETROIT, MICH., WITH A BUCYRUS-24 DRAGLINE**

The contractors, Walbridge & Aldinger, Detroit, used Blaw-Knox collapsible steel forms on this job



**A MODEL 152 PAWLING & HARNISCHFEGGER LADDER TYPE EXCAVATOR WORKING ON A SEWER JOB OF CHARLES F. SMITH & SONS AT DAYTON, OHIO**  
 The machine sold by the Sykes Company, Columbus, Ohio, has done good service, as is demonstrated by the type of material piled along the trench



**A MUNDY HOIST INSTALLATION ON A CONCRETE BUILDING JOB AT CHARLES SHUTRUMP & SONS COMPANY, YOUNGSTOWN, OHIO**  
 The hoist was sold by Brown & Sites Company, New York City



## Legal Decisions in the Contracting Field

Edited by A. L. H. Street, Attorney-at-Law

### Use of Streets and Sidewalks by Building Contractors

The law attempts to harmonize the right of travelers along streets and sidewalks to reasonably convenient and safe use of these public places with the right of abutting property owners and their contractors to make reasonable and temporary use of parts of the passageways for storing materials, etc. But when it appears that a contractor has made unreasonable use of a street or sidewalk, with silent acquiescence of the owner and the city, all three parties may become liable to one injured as a natural consequence. At least, that is what the Missouri Supreme Court decided in the late case of *Shafir vs. Sieben et al.*, 233 Southwestern Reporter, 419, a suit in which plaintiff was held to be entitled to recover for injuries sustained through being struck by an automobile while necessarily walking in a street, because a sidewalk had been completely obstructed by building materials. The Court said:

"It is true that the law authorizes the use of the street to a necessary and reasonable extent for the moving and placing of material to be used in an adjoining improvement; but the petition states that it negligently and unnecessarily used for that purpose, to the exclusion of the public, the entire sidewalk and nearly half of the street. Even the most massive buildings may be and constantly are erected without such inconvenience to the public. It also states that the traffic along Fifteenth Street was heavy at that point, and that it was in constant use by automobiles traveling at an excessive and dangerous speed. The accident happened in the night, when it is most difficult to ascertain the position and movements of automobiles and other dangerous vehicles. The knowledge of the city, express or implied, is sufficiently alleged. Under these circumstances, the petition imposed upon these defendants in error the duty of answering to the charge of unlawfully obstructing the street.

"The duty of the city to maintain the sidewalk in a safe condition for the use of footmen rests principally upon the necessity of preserving them from the inconvenience and danger of mingling with the traffic that resulted in this particular injury. The dedication, construction, and maintenance of the public streets is for the

benefit of the owners of adjoining property as well as of the general public, and these owners assume the duties incident to their position as such. Their right to obstruct the public in their use does not arise out of any title adverse to the public, but is an easement of necessity subordinate to the public control, and is limited by the necessity out of which it arises and must be reasonably exercised. The petition sufficiently charges that the obstruction placed and maintained in this street by the contractor and owners of the adjoining lot was unnecessary and unreasonable, and that the city in permitting its maintenance in violation of law was negligent. This is sufficient to sustain the liability of all these parties for damages resulting therefrom, and therefore called for an answer. The duty to keep the sidewalk free from unnecessary and unreasonable obstruction is imposed for the special benefit of pedestrians using it, or attempting to use it, in traveling along the street, and the plaintiff belonged to this class. When he was unlawfully excluded from the use of the sidewalk and compelled to go into the street, he was deprived of a right to which he, as well as all others similarly situated, was lawfully entitled, and is also entitled to such damages as may have been the proximate result thereof. The thing that happened was the very thing from which the imposition of this duty was designed to protect plaintiff."

### Effect of Building-Contract Clauses As to Partial Destruction of Work

Speaking of the effect of two particular clauses in a building contract, the California Supreme Court said in the recent case of *Gray vs. Bekins*, 199 Pacific Reporter, 767:

"The contract provided for an apportionment of loss between the owner and contractor in the event of a partial destruction by earthquake, but the contractor was not thereby relieved from performing the contract, nor did the contract require or authorize the owner to take possession of the building and repair the same in the event of a partial destruction. There was a provision in the contract authorizing the owner to supply the contractor with the men and material necessary to complete the work in the time required by the contract if the contractor failed to make adequate provisions along these lines after three days' notice by the owner. However, the effect of this provision was to permit the owner to furnish men and material for the contractor's use only; it did not authorize the owner to take charge of the work himself."

# Handling and Unloading Tank Cars

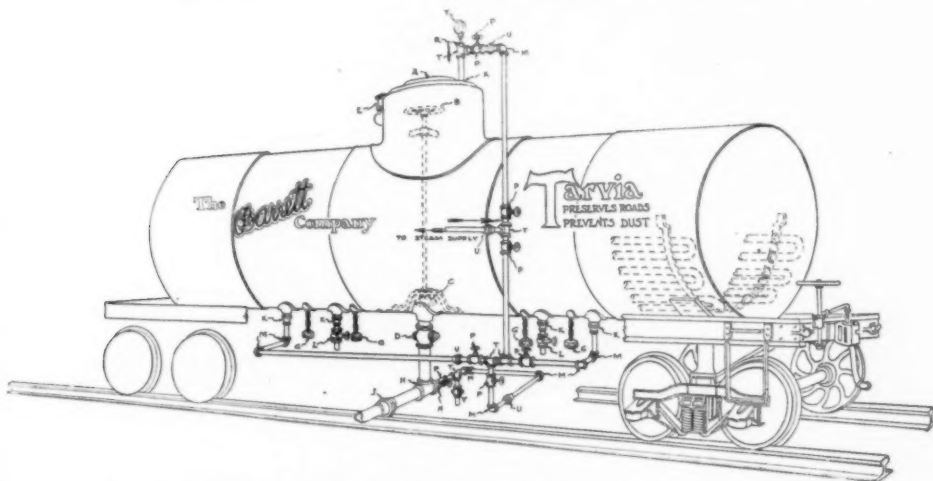
## Information for Contractors Handling Bituminous Road Materials in Tank Car-Load Lots

**I**N the road construction season next year contractors and road engineers will in larger numbers than ever before become acquainted with tank cars because of the increasingly large use of bituminous materials in road construction. The following material is prepared from the detailed instructions issued by The Barrett Company, 40 Rector Street, New York City, for the proper handling and unloading of BMX and GATX tank cars.

steam coils of either 1½- or 2-inch pipe. The inlets and outlets are of the same size as steam coils, and are marked with metal tags.

Before unloading a tank car the dome cover should be removed, to determine if the valve is properly seated. The 3-inch outlet stop-cock should then be examined to see if it is closed and in working order.

A 3-inch pipe with ground joint unions should be connected to the stop-cock and run to a



**A TANK CAR FOR SHIPPING LARGE QUANTITIES OF BITUMINOUS ROAD-BINDING MATERIAL TO BIG JOBS**

### Standard Equipment

Special study should be made of the diagram shown herewith. The dome cover has a ¾-inch opening which is plugged for connection when unloading by steam pressure. All the cars are equipped with safety valves, located at the side of the dome, set to release at 15 pounds. They are equipped with a tank car valve, operated by means of a hand wheel or lever in the dome of the car. Some hand wheels have a left-hand thread, some a right-hand thread, seating the valve correspondingly to the right or the left. The lever type valve is in closed position when free, that is, when released from the bracket. To open the lever type valve, the handle should be turned to the left, supporting the eccentric base on the bracket. The adjustment of nuts on the lever type valve should not be disturbed unless the operator has fully determined that the valves will not seat or open properly without so doing. All tank cars in Tarvia service have a 3-inch stop-cock at the outlet and have

point past the steel rails, as indicated in the diagram. This allows the easy connection or disconnection of the unloading line, should the car be switched. Before attempting to connect the unloading line, however, the inside valve and outside stop-cock should be examined as stated above. If for any reason the stop-cock or unloading line must be disconnected, be sure that the inside valve is first closed.

### Steam Coil Connections

The caps to each steam coil opening on the tank car are marked Inlet and Outlet No. 1 and No. 2. It is important that the steam supply line be connected with the inlet or inlets. Either one or both coils can be used. Some of the tanks have but one set of coils. The inlets to coils No. 1 and No. 2 should be reduced to ¾-inch or 1-inch openings protected by a valve between the steam boiler and the tank car coil. A ground joint union should be placed between the steam supply and the tank car for use in case it is

necessary to disconnect the piping. Inlets to both coils may be connected together, but in all cases it is best to have a separate exhaust from each coil. The valves should be so arranged that if one of the coils leaks, the other can be used by shutting the valve to the defective coil. The outlets to coils No. 1 and No. 2 should be reduced to at least  $\frac{3}{4}$ -inch, preferably  $\frac{1}{2}$ -inch. The exhaust steam can be used advantageously to heat the outside valve-seat, and also the nipple and cock.

#### Application of Steam

Before turning the steam into the coils, be sure that the outlet valves are wide open. Then admit steam slowly by gradually opening the inlet valves. About ten minutes at least should be allowed for the coils and connections to heat before turning on a full head of steam. Coils are easily ruptured unless the above procedure is carefully followed. After the coils have become thoroughly heated, open the inlet valve to a point where you have sufficient steam capacity from the boiler to insure an even pressure, and regulate the outlet valve so as to just permit the condensed steam to pass off from the coil. Particularly during the first hour or two of heating it is desirable to occasionally open the exhaust valve or valves wide in order to discharge all surplus condensate to insure efficient heating. Be sure to ascertain if the coils are functioning properly. Rumbling in the car or the presence of Tarvia in the exhaust indicates leaking coils. In the event that the steam coils have been damaged in transit, the contents of the tank car may still be heated by means of a temporary coil inserted in the dome of the tank car. A simple yet effective coil for this purpose can be made from two lengths of  $1\frac{1}{4}$ -inch pipe connected by two elbows and a short nipple in U-shape.

When it becomes necessary to use steam for unloading, the pipe connections connecting with the tank car in the dome at X should be installed. In applying steam, the control valve must be opened slowly and at a uniform rate, until the pressure is sufficient to force the contents out of the car. The maximum pressure required should not exceed 12 pounds, and under no circumstances should the maximum pressure exerted exceed 15 pounds.

In all cases, prior to admitting steam through the tank car dome all connections to the tank wagon or truck must be in place and all valves

and cocks on the unloading line should be wide open. Further, the use of dry steam is absolutely necessary; therefore, in the event that steam is not in use on the tank car coils, any condensate between the steam supply must be thoroughly blown out.

#### Caution

Among the particular cautions to take are the following:

When unloading the car by pumps or gravity flow, the dome collar should be opened to allow air to enter. It is extremely important that between removals of loads from the tank car the inside valve and the outside 3-inch stop-cock should be properly closed to avoid accidents if tampered with, and possible loss of contents. After a load is pumped out of the car, the inside valve should be closed; then open the  $\frac{3}{4}$ -inch cock V while the pump is still running, to drain the outlet nipple, the 3-inch stop-cock and the line to the pump. After the line is completely drained, be sure to close the  $\frac{3}{4}$ -inch cock V. After a load has been taken out by steam pressure, the inside valve should be closed, then the outlet nipple and the 3-inch stop-cock drained, then the stop-cock closed and the line blown with dry steam through the connections at the 3-inch tee H. After the tank is unloaded, close the inside valve and replace the dome cover. The outside 3-inch stop-cock should be left open until thoroughly drained. After the tank car is unloaded, ample time should be given for the steam coils to drain and cool before replacing the coil caps. In freezing weather it is best to leave the caps off to prevent the possibility of water's freezing and bursting the coils. Piping should be reduced to a minimum between the boiler and the tank car.

For Tarvia A and X a 35-horse-power boiler giving 80 pounds pressure or more will be found satisfactory. Cars incompletely emptied represent not only a loss of material to the purchaser but also entail a considerable expense for unloading. A few simple precautions in unloading the tank car will usually eliminate these troubles. Always endeavor to have the tank car placed on a level track, if possible, so that all material will have a chance to drain from the car. Care should be taken that the contents of a car are at a proper temperature before making any attempt toward unloading. The tank wagon or truck should be vented to the atmosphere during loading and transporting.

### Uniform Engineering Contracts

Six important changes in engineering contracts have been urged by the Engineering Association of Nashville for consideration by the American Engineering Council of the Federated Engineering Societies and the Associated General Contractors, as follows:

1. A satisfactory arbitration clause should be adopted and should be legally binding on both parties.

2. A definite policy of inspection should be adopted, and if two or more separate interests are concerned in payments for work, one authority shall act for all.

3. The contract should specify results, or the method to be followed, but not both.

4. The time of acceptance should be as early, and period of maintenance as short, as practicable.

5. The contractor should not be held responsible for contingencies beyond his control, and contingencies should be defined.

6. Reasonable limits should be placed upon the engineer's power to increase or decrease the amount of work to be performed by the contractor.

## Air-operated Steam Shovel in Tunnel Excavation

**T**HE Liberty Tunnels, Pittsburgh, Pa., composed of two separate tubes, each 26½ feet wide, placed 59 feet apart, center to center, and having a total length each of 5,715 feet between portals, have proved an interesting contracting job. These tunnels when completed will furnish a two-way street closely connecting the outlying residential district with the business section

larly, with the night shift drilling, blasting and clearing the corners of the heading for setting the wall plates. At the same time a similar gang is engaged in concreting the lining. The day shift sets the wall plates and the timbering with its lagging, putting in the rock packing back of the lagging, and by hand cleaning the heading while the shovel is working the floor, clears out both



USING A SHOVEL FOR MUCKING AT THE FACE OF THE TUNNEL

of the city. The contractors, Booth & Flinn, are operating by full-section face work and air-operated steam-shovel mucking. The material through which the tunnel is being driven is horizontally-bedded, non-water-bearing shale, which weathers rather rapidly, but for about a month after opening is not subject to slides and consequently puts little weight on the timbering. A simple arched roof timbering is used back of the face, which is drilled and shot in two sections.

The rate of progress of between 250 and 260 feet per month for each tube has been maintained regularly under this system.

### Method of Operating

A day and a night shift are used regu-

larly, with the night shift drilling, blasting and clearing the corners of the heading for setting the wall plates. At the same time a similar gang is engaged in concreting the lining. The day shift sets the wall plates and the timbering with its lagging, putting in the rock packing back of the lagging, and by hand cleaning the heading while the shovel is working the floor, clears out both

heading and bench muck. The day lining shift moves and sets the concrete forms. In this way the haulage service is divided, the tracks being used for concrete at night and for muck hauling in the daytime. Payment for excavation and timbering is made by a bonus system, based on 11 hours for a 9-foot advance and 12 hours for a 10-foot advance for the lining and timbering gangs, regardless of the time actually required. The adoption of this system after the beginning of the work produced a marked advance in the speed and regularity of the work.

The mucking shovel used in this tunnel is a model 41 Marion steam shovel of 1½ yards capacity and is operated by air. The shovel loads 4-yard dump-cars running on a 36-inch track and hauled in 5-car trains

by a mine locomotive. Outside the tunnel the muck has to be hauled about a mile to the dump in a public park, the track being

on a 6 or 7 per cent up-grade. For this service, steam locomotives are used. The total muck haulage is 200 cars per day.

## Lessons from the Chester Bridge Disaster

### Where Should the Responsibility Be Placed?

THE unfortunate disaster that occurred in Chester, Pa., on September 10, in which the lives of 24 people were lost, has been the cause of much deep thought on the part of engineers. The direct cause of the disaster was the overloading of the sidewalk of this bridge by a large crowd which was attempting to watch the rescue of a boy from the water. The crowd was thrown into the river by the breaking of a defective sidewalk bracket, and 24 people were drowned. The structure, itself a half-through plate girder bridge about 70 feet in span, had its sidewalk supported by 12-foot brackets, cantilevering from the girders, each bracket being about 3 feet deep at the inner edge and attached to the double stiffener angles of the plate girder by gusset plates at the top and bottom. The brackets were spaced about 12 feet apart. They were made of angle chords with a web-system of four panels in the 12-foot length. The upper attachment gusset of one of these brackets tore apart, allowing the bottom chord of the bracket to bend at its first panel point under the weight of the crowd. As the sidewalk tipped down, some 75 persons were thrown into the water.

The *Engineering News-Record* reports the result of an examination of the ruptured gusset plate of the bracket, stating that it had torn off along the outer edge of the plate girder stiffener. The upper part of the fracture was an old crack. The connection was of inferior design, also. The gusset was about 15 inches deep and 15 to 18 inches horizontally by  $\frac{3}{8}$ -inch thick. It was riveted to the bottom chord of the bracket, but bolted with five bolts to the girder stiffener. The corresponding plates of the other brackets, however, were riveted. The upper edge of the plate was flush with the top chord of the bracket, so that the pull was not central. The plate appears to be of wrought iron, moreover, and to have its rolling grain running vertical. The bridge was built by Cofrode &

Saylor in 1886, probably with the gusset in question.

For a distance of about 8 inches down from the top, the broken edge of the plate shows by a rusty surface that an old crack existed in the line of the fracture and that the crack worked downward progressively. It has been suggested that it had been damaged by a colliding vessel a number of years ago and had been removed for repair, the plate probably being straightened cold without removing it from the bracket angle, and the bracket being then replaced and attached by bolts instead of the original rivets.

An expert of the Pennsylvania Railroad Company, who examined the plate after the accident, judged that the crack might have been of one year's duration more or less, possibly even five or twenty years'. Furthermore, he stated that the crack could not have been discovered as the result of an ordinary investigation, because it would have been necessary to withdraw the rivets first.

### Who Was Responsible?

This accident again brings into the limelight the great value of the original plans together with a complete record of accidents, excessive loading and repairs which have occurred since the structure was initially placed in service. The responsibility for regular, thorough and systematic examination of our older structures, particularly those subject to motor truck loads which are large and cause heavy impact, is also forced upon those who have let well enough alone and used paint when small rust spots showed and have let the structure as a whole continue without thorough examination.

In this particular instance the responsibility or blame for the loss of these lives does not rest upon the crowd, upon the age of the bridge, or the material of which the plate was made, or the design, even though that was faulty, but seems to rest upon the individual who was responsible for the re-





THE SCENE OF THE UNFORTUNATE AND UNNECESSARY ACCIDENT IN CHESTER, PA.

pairs that were not thorough. Thus, the man in the shop who made a hasty and incomplete job of repairing the cracked gusset plate is the one upon whose shoulders the responsibility lies. It does seem, how-

ever, that the progressive crack might have been discovered by a thorough and adequate examination of the entire bridge structure at some considerable time prior to the accident.

## A Truck for Building Contractors

**T**HE building contractor, because of the various and rigorous haulage problems in his business, demands more from a motor truck than men in most other lines of business. To meet his exacting needs, a motor truck must have the power to haul capacity loads over all kinds of roads and grades. It must have the rugged strength to stand up under this work and to give continuous service day after day, year in and year out, because his profits depend upon the capability of his motor trucks to keep a constant supply of materials on the job so that his men will not be idle. Delays of material or equipment mean money to him. He cannot take risks and, therefore, his motor trucks must be absolutely dependable.

The Standard Motor Truck Company, Detroit, Mich., makes special claims for the Standard truck, which has been used by hundreds of building contractors in many cities and towns throughout the United States for the past ten years. The contractors testify that for hauling from excavation points to dumping-grounds

and for transporting sand, gravel, brick and other building supplies, Standard trucks have proved uniformly satisfactory.

The design of the truck embodies many of the most approved engineering practices and ideas. The engine is suspended at three points, which gives a more flexible mounting and cushions the hammer-like blows of deep ruts and prevents them from being imposed on the engine. The frame is made without a bend or curve, and is larger and more rugged than common practice recommends. The rivets in the frame are placed near the neutral axis instead of near the edges, thus insuring greater strength under stress and strain. The driving thrust is taken up by radius rods instead of through the rear springs.

The various parts going to make up the Standard truck are all of high-grade material and manufacture. The carburetor is a Stromberg; the magneto an Eiseemann; the radiator is the well-known and accessible Long vertical-built type, and the transmission and clutch bar



HAULING A CAPACITY LOAD OF STONE OVER AN UNPAVED HIGHWAY

the Brown-Lipe name plate. The propeller manufacture, and the front and rear axles and shaft and the universal joint are of Spicer the bearings are the Timken.

### Government Seeks To Solve Heavy Motor-Truck Problem

The proper regulation of unusually large motor trucks, because of their wear and tear to the nation's highways, or of restricting their use to certain roads designed to accommodate them, is suggested for consideration in the annual report of the Bureau of Public Roads, United States Department of Agriculture. The Bureau, under whose supervision Federal Aid funds totaling \$200,000,000 have been expended on highways costing \$467,000,000 during the past five fiscal years, asserts that the problem of the heavy motor truck is one of prime importance, pressing each year with more weight for solution, and, while not to be hastily solved, ultimately must be met squarely and disposed of.



A 3 1/2-TON STANDARD TRUCK WORKING ON A ROAD JOB

## Army Materials Ingeniously Used by States for Road Construction

By James W. Brooks

Director, American Highway Educational Bureau, Washington, D. C.

ONE hundred and forty million dollars is the estimated value of the surplus war materials, supplies, and equipment transferred to the 48 states by the Department of Agriculture up to November 1, 1921. The only reservation made by the Government in turning over these valuable supplies under the Wadsworth-Kahn Act is that they shall be used only in the construction and maintenance of roads.

Over 27,000 motor vehicles, both trucks and automobiles, and nearly \$12,000,000 worth of spare parts for them have been included in the transfer and, in addition, a great variety of machinery and supplies has been distributed, the mere listing of which requires ten closely typewritten pages.

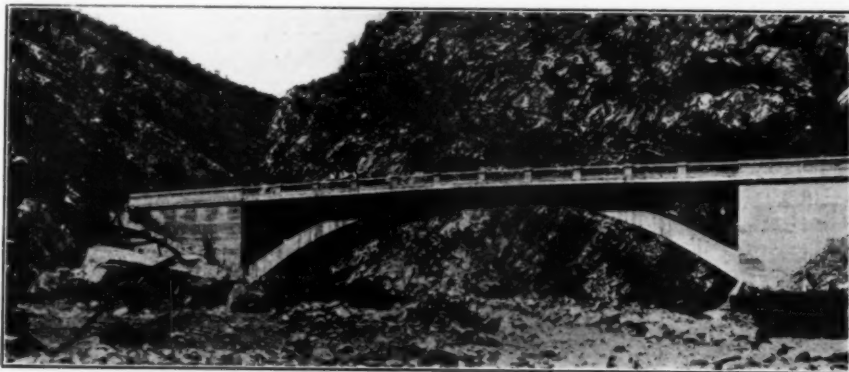
Although all of the material was purchased originally to meet the needs of the army in time of war, a large part of it can be utilized for highway construction without any alteration. In this class are hand tools of all kinds, such as picks, shovels, axes, adzes, chisels, etc., and machinery and equipment commonly used in road construction, such as cranes, derricks, steam shovels, wheelbarrows, jacks and other items too numerous to mention.

### Ingenuity in Alterations

In addition to such material as this, however, there were many other items of material declared surplus by the War Department which were not suitable for road-construction purposes in their existing form, but which the states have found ways to alter and utilize to excellent advantage. The story of some of the ingenious and economical uses of this material, designed primarily for warlike purposes, forms an interesting chapter in the record of the tremendous salvaging operation which has been carried on under the Wadsworth-Kahn Act.

The motor trucks, of which over 23,000 have been transferred, are perhaps the most valuable equipment which the states have received. As they were received from the army, they were generally not suitable for road construction purposes, on account of the shape and size of their bodies, which were designed especially for army use. But the states have altered these bodies, in some cases in their own shops built for the purpose, thereby converting the trucks to a number of special uses.

The majority of the trucks have been



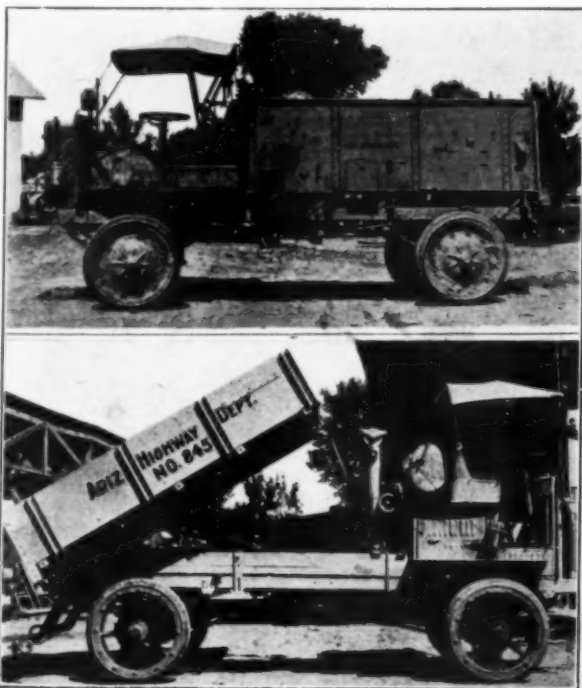
QUESN CREEK BRIDGE, ARIZONA, A FEDERAL AID PROJECT

The hand-rail is made of surplus war pipe previously used to carry compressed air to jack-hammers

altered by substituting dump bodies and hoisting devices for the cargo and ammunition bodies with which they were equipped when received. In some cases new bodies have been built outright; in others, the army bodies have been converted. Idaho, for example, has converted the steel ammunition bodies into hopper bodies by installing false bottoms sloping from the front and back to a pair of drop doors for bottom dumping, which are controlled from the driver's seat. Maine has removed the cargo body from the chassis, and by pivoting it near the rear end and adding a hoisting device has made the army body into a dump body. The same state and also Vermont have altered the army bodies by arranging the sides so that they can be dropped or raised, permitting the load to be dumped from the side of the truck.

Arizona sized up the trucks equipped with steel ordnance bodies and decided that for road work they were too high and not wide enough. To make them suitable, the highway engineers cut the bottom in half from front to back, and then used the sides, thus making the body about twice as wide and half as high. The change makes it easier to shovel into the truck when necessary and also permits the hauling of more bulky material. In addition, the trucks have been equipped with hand hoists and offset bars on the rear end in order to pull road scrapers and drags.

In addition to being used for hauling road materials, many of the trucks have been converted to other uses. Army ambulances have needed a few alteration to make them admirable survey cars. A few changes also convert these vehicles into trucks for the transportation of convicts to and from their work on the roads. Nearly all the states in which there is any snow problem have utilized a portion of their truck allot-



ABOVE—ORDNANCE TRUCK AS RECEIVED FROM THE GOVERNMENT. BELOW—THE SAME BODY AS CONVERTED BY ARIZONA FOR ROAD WORK

ment in winter to push the snow-plows; and one of the common conversions is that which results in a very serviceable sprinkler truck.

Odd but ingenious use has been made by New Jersey of a Mack truck originally intended as a water sprinkler and equipped with a centrifugal pump which was mounted beneath the tank and driven by the propeller shaft. This was changed to a machine for spraying whitewash on poles along the state highways. The sprinkler heads at the rear were disconnected and two other connections were made from the outlet of the pump—one extending forward, the other to the rear. The forward connection was carried to pipes at each side, which rise to the top of the cab and are there connected to garage car-washing swivels. The other connection enters the tank through the filling cap in the bottom. Inside the tank on this connection was placed an ell with a short nipple pointing forward. This connection was made for the purpose of agitat-



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ing the whitewash mixture by pumping a part of the mixture back into the tank, and in order to increase the agitation the nipple at the end of the connection was flattened. The spraying mixture is pumped through the forward connection, and the garage swivels, lengthened to 10 feet with 25 feet of hose attached, permit traffic to pass while the truck is at work.

#### Storage Structures

Arizona has built a warehouse for the storage of its transferred equipment out of material also received from the Government. The sides of the 50 by 100-foot buildings are covered with corrugated iron, of which some 5,000 sheets have been distributed by the Bureau. The very efficient awnings over the office windows are made of extra tops for truck drivers' seats.

In other states the problem of providing temporary storage space for transferred war material has been solved by the use of the canvas airplane hangars, several hundreds of which have been distributed.

Among the items which appear in the list of distributed material are two described as "shelters, elephant and trench." It would be difficult to imagine anything less likely to be of value in road construction than these heavy, semicylindrical bomb-proof iron shelters which were designed for the purpose of protecting our soldiers from the shells of the enemy. Yet thousands of these shelters have been distributed by the Department of Agriculture and put into service in a number of useful ways by the states. The most common use of them has been as storehouses and magazines for the storage of Government TNT and powder. It is probable that this use was suggested by the original purpose of the shelters. Colorado has departed a little further from the original purpose; and though it uses them for protective purposes, the protection sought is against the storms of mountain passes in which they have been erected. Arizona has gone farthest afield in its ingenious use of them as culverts. In the large desert areas of that state it seldom rains, but the rain that does fall is likely to come in cloudbursts which flood the desert and frequently wipe out the roads that cross the wide, shallow drainage channels, unless they are amply protected by culverts of liberal size. It is as a means of protection against these floods that the state

is transforming the bomb-proof shelters into culverts. They are built on concrete foundations where sand and gravel are accessible, or on redwood in the absence of these materials. The rainfall is so infrequent and the desert soil is so porous that excess moisture is quickly absorbed, and it is thought that the shelters, well painted, even if not galvanized, will have a length of life which will amply justify the cost of installation.

#### Doubtful Assets Made Valuable

Although no material has been sent to any state except upon the request of the state authorities, some question has been raised as to the value of certain materials for road work. One of the items questioned was the artillery harness, over 16,000 sets of which have been distributed. For army use this was made as breast harness, which differs from the hame harness commonly used. In its original form, therefore, it was valueless, but its usefulness when properly altered has been shown by the experience of a number of the states typified by the following report from Arizona. The State Engineer says: "The breast harness received by the state of Arizona from the Government has been changed to hame harness by our local saddleries at a cost of \$10 per set. Thus changed, each set is easily worth \$40 to the state. We are now hiring stock without harness at a decreased price of \$5 per team, so that the rent saved in three months pays all the expenses of freight on the harness and of necessary alterations."

Until the transfer of war materials placed it in the hands of the state road builders, TNT had never been used except by the army. In the popular mind it was regarded as the most dangerous of explosives—far more dangerous than dynamite, and entirely too dangerous for use except in time of war. This erroneous impression was dispelled by scientific investigation, and the states were induced to try some of the explosive in their work. A single trial has been sufficient to convert the most suspicious blaster, and it is now generally preferred to dynamite by those who have used it. Nearly 20,000,000 pounds has been transferred to the states, and the Bureau of Public Roads has used over 7,000,000 pounds in connection with its own work on the national forest roads.

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and sizes has been saved from useless deterioration and put to work by the several states. It is safe to say that it has been used in nearly all the ways in which pipe can be used. A great deal of it has been used to carry water to concrete mixers. Nebraska has used the 2-inch size for heating coils to warm the garages which house the war trucks; and a great deal of the same size has been used to form the hand-rails of bridges and culverts. A most interesting example of the manner in which the transferred material is helping the states to solve their problems is that of Queen Creek Bridge on the Superior-Miami Highway, Arizona. The hand-rail of this bridge is made of 4-inch wrought-iron pipe received from the Government. Before it went into the bridge rail, however, it was used to carry compressed air from ex-Government air compressors to the jack-hammers used in the excavation of the bridge foundations. Incidentally, in addition to the assistance which the state has received by the transfer of Government material which has been used in this bridge, the state has also received financial aid under the Federal Aid act.

Most interesting of this material are the sectional bridges. Two types of sections are provided, one type 17 feet 7½ inches long, to be used at the ends of the bridges, and the other, 11 feet 3 inches long, to be used as intermediate sections. Floor beams and stringers are included. The sections are uniformly 5 feet 11 inches deep, and when erected according to the army plans the trusses are spaced 14 feet apart and provide

for an 11-foot roadway. They were designed to carry trucks and heavy artillery and will safely carry trucks of 15 tons gross weight for spans up to 114 feet.

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The general attitude of the states toward the distribution of this material was recently manifested in a resolution of the executive committee of the American Association of State Highway Officials, expressing the appreciation of the state departments. How valuable it has been to some of the states is shown by a recent statement issued by the Nebraska Department of Public Works, which says in part:

"Financially the state of Nebraska was saved thousands of dollars by the receipt of the material, for by being in a position with our own construction organization (made up of this equipment) to take any contract at any time, we were able to force the keenest kind of competition and reduce bid prices to as low as or lower than those received in other states.

"Second, with regard to mileage built, 60 per cent of the road work completed this year would have been totally untouched had the equipment not been available. Nearly 1,500 miles were constructed by gangs outfitted with this equipment."

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*From Highway News Digest.—*

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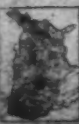
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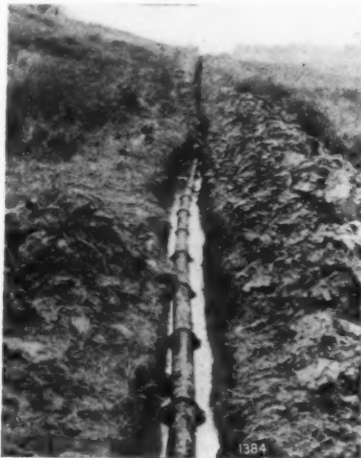
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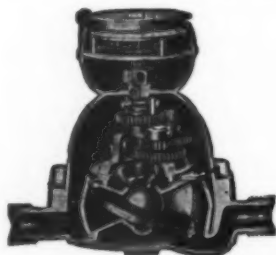
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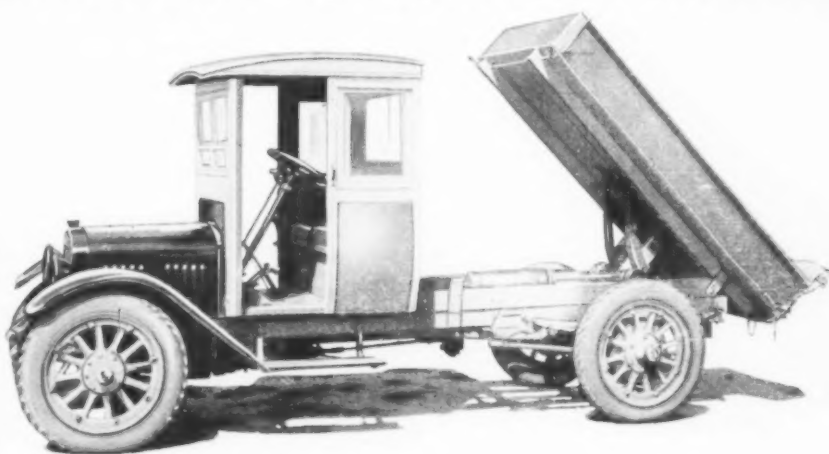








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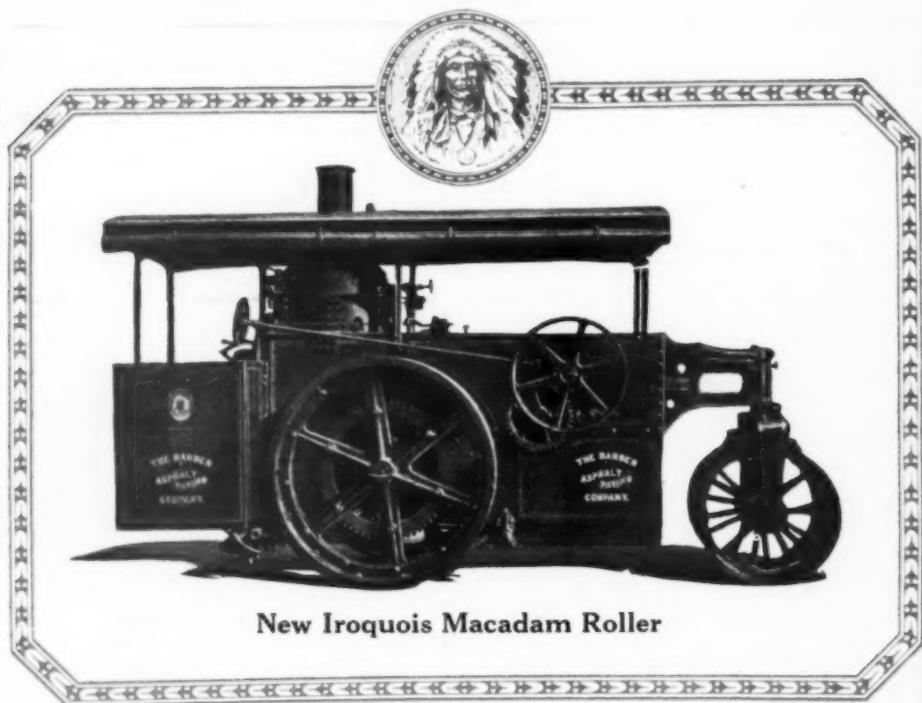
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